# A TAXONOMIC TREATMENT OF THE LUZULAE GROUP OF CYPERUS 

by

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## INTRODUCTION

Worldwide in distribution, the Cyperaceae include approximately 72 genera and 4000 species (Koyama, 1961; Cronquist, 1968). The family is thought to have evolved within the last 90 million years during the Tertiary Period (Raven \& Axelrod, 1974) in tropical and subtropical regions where the greatest diversity of generalized or primitive genera currently exists. Subsequent migration has distributed taxa both northward and southward. The majority of species is located in the cool regions of both hemispheres, chiefly because the largest, most specialized genus Carex consists of more than 1100 species and commonly occurs in temperate to arctic latitudes. Cyperus, along with less specialized genera, is primarily centered in subtropical and tropical zones. The respective distributions of Carex and Cyperus attest to the fact that morphological specialization in the Cyperaceae has apparently accrued with migration away from tropical regions. The plants in the family are herbaceous, wind pollinated monocots that mostly occur in open communities of marshes or wet meadows. The features that characterize the family are typically triquetrous solid stems, three-ranked leaves with closed sheaths, reduced bisexual flowers borne in spikelets and subtended by scales, perianth segments absent or modified as bristles or scales, basifixed anthers, and one-seeded indehiscent fruits. Classification within the family has been influenced by these trends: 1) change from unifacial to bifacial leaf blades, 2) change from undifferentiated to differentiated prophylls, 3) change from cymose to spicate spikelets, 4) change from continuous to jointed rachillas, 5) change from spirally arranged to distichous scales in the spikelets, 6) loss of perianth bristles or scales, 7) change from bisexual to unisexual flowers, 8) loss of one or two stamens, and 9) loss of one carpel. The extent of variation of many of the species is still inadequately known and has led to disagreement about recent classifications of the family. In most schemes, cyperologists have recognized between two and four subfamilies with four to seven tribes.

Cyperus is the second largest genus in the family, comprising at least 550 species and perhaps as many as 900 . All of the recent classificatory systems include Cyperus in tribe Cypereae of the subfamily Scirpoideae (Kükenthal, 1936; Mattfeld, 1936; Ohwi, 1944; Koyama, 1961). In his generic monograph of Cyperus, Kükenthal (1936) recognized six subgenera encompassing 61 sections. The sections were primarily delineated by the nature of branching of the compound inflorescence, extent of development of the rhizomes, and the number of stamens and carpels per flower. My recent studies have shown that many of Kükenthal's sections need revision before a natural classification of the genus can be proposed. Regional studies are decidedly less valuable in large genera such as Cyperus that have successfully utilized long-distance dispersal as well as gradual processes of short-distance migration and specialization; it is especially important in these groups to investigate purportedly phylogenetic units if species relationships are ever to be fully assessed.

Six of the species included in section Luzuloidei by Kükenthal (1936) are here excluded (see Excluded or Extralimital Names); the remaining fifteen taxa originally classified in the section are native to North and South America and appear to form a natural evolutionary group. Until enough information can be acquired to enable better sectional delineation in the genus, I will refer to this collection of taxa as the Luzulae group. Other studies (McGivney, 1938; Ayers, 1946) have dealt with some of the

North American taxa included here, but did not account for their overall morphological variation. In this study, the vegetative and reproductive structures of the taxa in the Luzulae group have been analyzed for their total range of distribution. These taxa are characterized by headlike clusters of spikelets, eglandular leaves, involucral bracts of unequal length, persistent rachillas continuous with the peduncle, three-veined deciduous scales, proximal abaxial groove on each of the scales, three-carpellate gynoecia, usually one stamen (seldom two) per flower, and brown or black achenes. The abaxial groove on the scales is either absent or inconspicuous in other complexes of Cyperus.

## MORPHOLOGY

Habit. All taxa in the Luzulae group are herbaceous perennials in all or part of their geographic ranges. In the north temperate zone, the annual habit may occur in two species. Cyperus acuminatus is typically an annual distributed throughout the United States, but occurs as a short-lived perennial in the southern part of its range in Texas and Louisiana; and Cyperus surinamensis may be an annual in the northern part of its range in Kansas and Oklahoma, but is usually perennial from southeastern United States, south through Central America, and in South America.

All taxa are erect, herbaceous, and less than 120 centimeters tall. The two varieties of C. reflexus characteristically form scaly rhizomes, while the rest are tufted. Each of the erect, aerial stems bears several three-ranked leaves proximally, and a diffusely branched or contracted compound inflorescence terminally. The leaves have sheathing bases and ascending blades that are shorter than or equal to the length of the stem.

Prickle-hairs. The only type of epidermal "hair" found in the Luzulae group is the crystalline, unicellular prickle-hair, one that is ubiquitous in the Cyperaceae. The presence of these hairs on any organ brings about what is often termed a scabrous or scabrellate condition. Prickle-hairs are common to abundant on the margins of involucral bracts and leaf blades, but often abscise as the bracts and leaves age. In Cyperus surinamensis, the prickle-hairs are typically found on the distal one-half of the stems, and in C. virens, they are found on the three winged angles of the stem. Occurrence of prickle-hairs on the stems of other taxa is sporadic, but their presence may indicate previous hybridizations. In C. acuminatus, the stems are mostly smooth, but they are scabrellate on a few specimens, collected in Texas, that are putative hybrid derivatives between C. acuminatus and C. surinamensis. Prickle-hairs may also be found on the peduncles, bracts, and scales of the compound inflorescence.

Aerial stems. The mature stems (or culms) of the Luzulae group have a silicified epidermis, vascular bundles embedded peripherally in a chlorenchymatous cortex, and a hollow center. The ground tissue in the center of the young stem tears and disintegrates during development. All stems are a few millimeters broader at the base than just below the inflorescence. In cross-section, the stems may be round, roundly triquetrous, or triquetrous. Numerous longitudinal ribs and grooves extend the full length of the stem in all taxa, and are more conspicuous in stems that are round or roundly triquetrous than in triquetrous stems. Three species, Cyperus eragrostis, C. intricatus, and $C$. virens, have triquetrous stems, but only $C$. virens exhibits wings on the three prominent angles. The triquetrous and winged conditions of the stem appear to be specialized features in the Luzulae group.

Foliage leaves. The three-ranked leaves of the Luzulae group arise near the base of the stem, number three to thirteen, and have weakly differentiated sheaths and
blades. The leaf sheath is no more than one-third the total length of the leaf, membranous on the portion opposite the blade, and naturally closed (tubular). The basal diameter of the plant enlarges as new leaves are formed, causing the outer leaf sheaths to tear along their membranous portions. Reddish veins are characteristic of the sheaths of C. reflexus, and occasionally occur in C. acuminatus, C. distinctus, and C. virens. The blades are strap-shaped, typically wiry and coarse (thin and flexible in $C$. acuminatus), and with common to abundant prickle-hairs along the margins, at least when young. Of diagnostic importance, the sheath and blade show nodulose transverse septa in certain taxa; in the varieties of $C$. virens, these are conspicuous.

The usefulness of anatomical studies has been demonstrated in several studies (Metcalfe, 1969, 1971; Koyama, 1967). Several workers (Dunn, Sharma, \& Campbell, 1967; Koyama, 1966, 1967) have reported that the stomatal complexes in various monocotyledons show little infraspecific variation, and Stebbins and Khush (1961) suggested that specialization of stomata in the Cyperaceae has proceeded from tropical to temperate areas. To analyze the anatomical characters of the Luzulae group, preparations were made of the upper and lower epidermis of leaves and involucral bracts of ten individuals of each taxon, following the methods of Metcalfe (1960). The cellular patterns, hairs, and stomates were studied for each. Since the anatomical characters of both epidermal surfaces of involucral bracts are comparable to those of foliage leaves, only the measurements of foliage leaves are given (Table 1).

The epidermal cells on both surfaces are arranged in lengthwise rows and have anticlinal walls that are sinuous and silicified. The rows are similar on the upper surfaces, but are differentiated abaxially into costal (overlying the vascular tissue) and intercostal zones. In each of the costal zones, the epidermal cells comprising the three to five rows of cells are smaller than those in the adjacent intercostal zones.

Table 1. Features of the epidermal surfaces of leaves. All measurements of length and width are in microns.

| Taxon | Adaxial Epidermal Cells: 1/w | Abaxial Epidermal Cells: 1/w | Epidermal Cells in <br> Stomatal <br> Rows: 1/w | $\begin{gathered} \text { Stomates } \\ 1 / \mathrm{w} \end{gathered}$ | Number of Silica Bodies per Cell |
| :---: | :---: | :---: | :---: | :---: | :---: |
| acuminatus | 68-130/36-50 | 90-140/26-36 | 50-190/25-32 | 50-52/26-30 | 1-2 (-3) |
| distinctus | 40-60/18-28 | 95-165/10-30 | 50-80/12-26 | 36-46/22-28 | $1-2(-3)$ |
| eragrostis | 75-120/25-30 | 50-125/20-30 | 55-80/18-20 | $35-36 / 22-28$ | 1-2 |
| intricatus | 45-150/20-30 | $75-125 / 20-25$ | 50-75 /15-20 | 40-45/20-25 | 2-3 |
| luzulae | 34-100/32-40 | 32-84/16-26 | 30-100/16-26 | 34-48/24-30 | 1 |
| ochraceus pseudovegetus | 76-105/40-50 | 55-115/20-30 | 44-50/20-28 | 36-46/24-30 | 1-2 |
| v. pseudovegetus pseudovegetus | 75-150/25-40 | 85-115/20-25 | 30-50/15-20 | 35-40/20-25 | 1-2 |
| v. megalanthus reflexus | 58-175/20-40 | 50-100/14-35 | 50-80/14-25 | 30-36/24-30 | 3-7 |
| v. reflexus reflexus | 50-96 /36-50 | 50-96/18-26 | 40-66 /22-32 | 32-36/20-36 | 1 |
| v. fraternus | 60-115/25-30 | 50-90/15-25 | 35-50/20-25 | 35-40/25-35 | 2-3 |
| surinamensis virens | 55-105/44-48 | 25-75/22-26 | 30-72/24-30 | 34-46/22-28 | 2 |
| v. virens virens | 30-42/22-24 | 64-90/26-30 | 34-76/20-25 | 24-30/24-28 | 2-3 |
| v. drummondii virens | 70-110/35-40 | 50-105/33-35 | 30-50/25-30 | 30-35/25-30 | 1-2 |
| v. minarum virens | 80-140/35-45 | 45-150/20-25 | 65-100/20-25 | 35-40/24-25 | 2-5 |
| v. montanus | 75-150/35-60 | 90-110/25-27 | 65-85 /25-30 | 35-36/25-30 | 1-2 |

There may be as many as twenty rows in each of the intercostal regions. Two to five stomatal rows usually occur in each intercostal zone and may be separated from each other by one or two nonstomatal rows and from the costal zone by one to five nonstomatal rows. The epidermal cells in the stomatal rows are smaller than those in the intervening nonstomatal rows (Table 1). On a single individual, the lengths of epidermal cells are comparable on both surfaces, while the widths of cells on the lower surfaces are generally smaller than those on the upper ones (Table 1).

Silica-bodies are formed only in the abaxial epidermal cells in the costal zone. They are conical, with the widest and basal portion attached to the inner periclinal wall and with the apex directed toward the outer periclinal wall; in surface view, they appear circular. Within the genera of the Cyperaceae, the number of silica-bodies per cell is known to have phylogenetic significance (Metcalfe, 1971). In the Luzulae group, the number of silica-bodies per cell is one to three for most of the taxa, indicating close affinities. The two exceptions are of purported hybrid origin, C. pseudovegetus var. megalanthus and $C$. virens var. minarum, and have three to seven and two to five silica-bodies per cell, respectively.

Stomates are found almost exclusively on the abaxial surface in the intercostal zone and appear circular or elliptic in outline. They are paracytic, with the narrow subsidiary cells nearly obscured by the large dumbbell-shaped guard cells. The size of the stomates in the temperate species (especially in C. acuminatus, C. distinctus, and C. intricatus) is usually greater than in taxa with wider or more tropical distribution patterns (Table 1).

Involucral bracts. The involucral bracts terminate the stem, and individually subtend the primary peduncles. They are unequal in length and usually number two to eight, but may be as numerous as forty, as in C. pseudovegetus var. megalanthus. The bracts mostly resemble foliage leaves, are often conduplicate, and either lack or have a minute sheath at their base. The lowermost involucral bract of C. reflexus, and occasionally of C. acuminatus and C. intricatus, is differentiated from that of other taxa in that it is wiry and mostly erect, and appears like a continuation of the stem. The nodulose transverse septa are conspicuous on the involucral bracts of the varieties of $C$. virens and either inconspicuous or absent in other taxa. As with foliage leaves, crystalline prickle-hairs occur on the margins but are often rubbed off or fall off with aging. Epidermal patterns of both bract surfaces are similar to those of foliage leaves. The only significant difference is that the size of cells on upper bract surfaces is greater than those on adaxial leaf surfaces.

Compound inflorescence. The compound inflorescence in the Luzulae group is composed of several to numerous peduncles, each terminated by clusters of spikelets called heads. Both the peduncles and the rachillas of the spikelets are branches and can be recognized by the presence of two modified basal leaves, namely an involucral bract or bracteole and a prophyll. The primary peduncles are subtended each by an involucral bract while the secondary and tertiary peduncles and the rachillas are subtended by bracteoles. All are ensheathed basally by a tubular prophyll which is located just above the subtending bract or bracteole. The size, shape, and number of veins of the prophylls are of significance in differentiating some species of the Luzulae group. The prophylls are also useful in understanding the relationships between genera of the Cyperaceae (Blaser, 1941, 1944; Koyama, 1961).

In most taxa, primary peduncles are common, secondary peduncles are occasional, and tertiary peduncles are infrequent to rare. When all of these are evident, the compound inflorescence exhibits a diffuse branching system, as in C. virens var. montanus. In all taxa, there are several branch systems within each head, most of which remain short and are not evident except by dissection or anatomical analysis. The failure of peduncles to develop does not seem to be particularly important
taxonomically, as such variability is noted in most taxa, often within a single population. In some taxa, though, the lack of primary peduncles is more common than their presence. Such compact inflorescences with sessile heads are often observed in $C$. luzulae, C. reflexus, and C. surinamensis. When the secondary or tertiary peduncles within a head fail to elongate, the head increases in size and is irregular in shape. The developmental stimulus that controls the formation of peduncles needs to be analyzed before the presence or absence of these structures can be used reliably in systematic studies. The standard "type" of compound inflorescence in the Luzulae group is one where the primary peduncles are well developed and the secondary peduncles weakly developed. Pedunculate heads, if present, are usually smaller and more numerous, and contain fewer spikelets than the sessile ones. Specialization in the Luzulae group appears to have involved both the reduction of primary and secondary peduncles to form a compact, sessile compound inflorescence, and the amplification of tertiary peduncles to create a diffuse branching system.

The ultimate branch system in the compound inflorescence is that provided by the spikelet. These are spirally arranged in tight clusters and aggregated to form heads. The number of spikelets per head varies within a taxon and depends on the extent of development of the branch systems. The spikelets in the Luzulae group are laterally compressed and usually ovate, and have two-ranked scales. All are characterized by the presence of a bracteole and prophyll at base. The spikelets show indeterminate growth since the scales and their enclosed flowers develop and mature acropetally. The rachilla is continuous with the peduncle and mostly straight, but sometimes is arched in the lowermost one-half when the spikelets are crowded to form a dense head. Only a few hyaline fragments may be left on the sides of the rachilla when the scales abscise. The raised scale scar on the rachilla is conspicuous, and can be used to determine the width of the proximal groove between the two keels on the scales and also to determine the distance between scales on one side of the spikelet. The development of the rachilla appears to be governed by a mechanism similar to the one that controls the length of the peduncles. Most spikelets are between 1.5 and 16 millimeters in length and bear fewer than 40 scales. Cyperus ochraceus is an exception, as certain of its populations may have spikelets up to 35 millimeters in length, with up to 88 scales. The larger spikelets in C. ochraceus could easily be produced by an elongation of the rachilla and the formation of more scales and flowers along it. Increased length of the rachilla appears to be a specialization of the spikelet. The angle of the scale's declension from the rachilla is also of taxonomic significance. In most taxa, the mature scales are declined $30^{\circ}-60^{\circ}$, but in $C$. ochraceus they are usually perpendicular to the rachilla. The greater the angle of declension, the easier it is for an achene to become dislodged from its subtending scale.

Scales. The scales in the Luzulae group vary with respect to the proportion of their length and width, and their shape, texture, apex, attachment at the base, proximal abaxial groove, color, and margins. The two-ranked scales are borne on a quadrangular rachilla. The medial portion of the scale is fused along the widest portion of the rachilla, and the two sides of the scale are partially or completely fused to the narrow sides of the rachilla. The boat-shaped scale has a proximal groove, located between the two basal keels, that extends toward the apex. Where the groove ends, usually near the middle of the scale, the two keels dissipate or merge to form a single distal keel. Usually the back of the scale is slightly rounded distally. The nature of the scale apex is taxonomically useful in some taxa; the apex is incurved in C. luzulae and C. ochraceus and generally excurved in C. acuminatus, C. pseudovegetus, and C. reflexus. The texture of the scale often varies at different stages of its maturity. While young, the scale is typically light brown or yellow and possesses a membranous, reticulate, surface pattern. As the scale matures, it often deepens in color and becomes
smooth and glossy. Because of the acropetal maturation of the spikelet, both reticulate and smooth, glossy scales can frequently be observed in the same spikelet.

Each scale exhibits three prominent longitudinal regions. The subcartilaginous or firmly membranous, middle part of the scale is wider than the two keels and can be easily observed in lateral view. The three veins of the scale are found within this region and these may or may not coincide with the position of the keels. The membranous to crustaceous sides of the scale taper slightly toward the base. Only C. distinctus, C. luzulae, and $C$. virens have scales that are as broad at the base as at mid-length. In $C$. ochraceus, the scale base is wider than in most other taxa, and here the lateral sides are only partially attached to the rachilla.

The scales characteristic of the Luzulae group disarticulate from the rachilla acropetally. The scales of $C$. distinctus are tardily deciduous, whereas those of $C$. intricatus are often retained on the rachilla. The retention of scales and the transitional state of tardy disarticulation indicate a reduced dispersibility of the fruits. Predictably, the geographic distributions of both $C$. distinctus and $C$. intricatus are limited in scope.

Flowers. The bisexual flowers, each subtended by a scale, consist of one or two stamens and a tricarpellate gynoecium. The stamens represent an asymmetric whorl and are derived from a more generalized condition where there was one whorl with three stamens. The prototypic cyperaceous flower, however, is thought to have had six stamens arranged in two whorls (Blaser, 1941). When there is only one stamen per flower, it arises between the gynoecium and the scale, but the filament sometimes curves around the edge of the gynoecium and is appressed between the adaxial surface of the gynoecium and the rachilla. As an indication of structural symmetry on a single side of the spikelet, the stamen arises first from one side of the gynoecium, and then from the opposite side in the flower immediately above the first. When there are two stamens, as in $C$. intricatus and in some varieties of $C$. virens, they arise abaxially at the edges of the stipitate gynoecium, but the filaments invariably curve forward and are appressed between the rachilla and the gynoecium. The anthers develop while still enclosed and protected by the subtending scale; they become evident in anthesis when the filaments elongate and reach full length just prior to anther dehiscence. After dehiscing, the anthers dry and abscise. The compound, trigonous gynoecium has a trifid style that is deciduous as the fruit ripens and has a persistent base modified either into a narrow and short stipe or into a spongy and torulose structure as wide as the rest of the achene.

Fruits. The one-seeded indehiscent fruits are nutlets that are commonly called achenes. They range from two to seven times longer than wide, and are all trigonous. The mature size of the achene is typically achieved before its coloration and detailed surface pattern become evident. The surfaces are obovate, elliptic, or ovate in outline, and may be either concave, planar, or convex. The three surfaces are usually similar, but sometimes the two that are abaxial are of different shape or width than the adaxial one. Rarely, one of the abaxial surfaces is different from either of the other two. As a result, symmetry of the achene can be radial, bilateral, or irregular. Often there are inviable fruits that appear yellow, translucent and practically empty; these may occur in a spikelet along with plump viable fruits. Maturation and abscission of the achenes, as with the scales, proceeds acropetally. When ripe, the achenes fall from the rachilla, either before, after, or simultaneously with the scales and filaments; the achenes retain their stipitate or spongy base and apiculate tip when shed.

## DISTRIBUTIONS

Distribution patterns of the fifteen taxa in the Luzulae group are correlated with morphological features of the reproductive structures. The shape, size, and orientation
of the scale that subtends a flower are correlated with the shape, dimensions, and dispersibility of the achenes. In the Luzulae group, increase in dispersibility is recognized by readily deciduous scales, reduced size of the achenes, and an increased angle of declension of scales from the rachilla (greater than $60^{\circ}$ ). Loss of dispersibility is associated with the retention of scales on the rachilla, enlargement of the achenes, development of an enlarged spongy and torulose base of the achene, and an angle of declension that is between $30^{\circ}$ and $45^{\circ}$. Similar changes resulting in the loss of dispersibility of fruits and seeds have been noted for plants of insular floras (Carlquist 1966a, 1966b, 1974).

The taxa included in the Luzulae group are native to the New World and exhibit distribution patterns that are restrictive, disjunctive, or continuous. Geographically restricted taxa are represented by Cyperus distinctus, which occurs only in the southeastern United States and the West Indies, and has a large achene with an enlarged spongy base; and by C. intricatus, which occurs only in southern Brazil and northern Argentina, and has scales that do not readily disarticulate when mature. Of the taxa that occur both in North and South America, for example C. luzulae, the achenes are small and the scales readily disarticulate. Disjunctive patterns are provided by C. virens var. drummondii which occurs in Louisiana, Texas, Nicaragua, Jamaica, continental South America, and the Galapagos and by C. eragrostis which occurs naturally in the Pacific coastal zone of the western United States and the southern part of South America. The morphology of the scales and achenes of disjunctive taxa is similar to that of taxa with widespread continuous distributions. Possible explanations for apparently disjunctive patterns include: diminution of a once extensive distribution, long-distance migration, inadequate exploration or collecting, or multiple origins of the taxa. Extinction of intermediate populations of species that were at one time widespread appears to be the best explanation for the disjunctive patterns in $C$. reflexus and C. virens. Long-distance dispersal, however, may account for the northsouth disjunction of $C$. eragrostis.

## RELATIONSHIPS OF THE TAXA

The relationships of the fifteen taxa were assessed by evaluating those characters principally used in the descriptions of the taxa. To form the data base, 75 characters were tabulated (Table 2). Four analyses were then performed: 1) using all 75 characters; 2) using 20 "evolutionary" characters; 3 ) using the 17 vegetative characters; and 4) using the 58 reproductive characters. Two computer-assisted programs were employed to aid the analysis: a clustering routine, MINFO, and discrimination analysis.

MINFO is a polythetic, agglomerative, and hierarchical classification procedure using an information statistic (Orlóci, 1969). The program was provided by the Environmental Sciences Division at Oak Ridge National Laboratories and included documentation (Goldstein \& Grigal, 1971) and a punched program deck. In this study, each taxon represents an OTU. During each clustering cycle, that pair of OTUs or group of OTUs is joined which results in the minimum information gain. The program continues to cluster until all OTUs are joined. Dendrograms may then be produced by connecting OTUs (taxa) at the appropriate level of mutual information. These depict the relative affinities of the taxa to each other.

The clusters of the MINFO program are subjected to SPSS Discriminant Analysis (Nie, et al., 1975) primarily to obtain a rank order of importance of the characters used as discriminators. Also provided is a matrix of Wilks Lambda values to test for significant differences between groups at each step; as these measures decrease, the significance for group separation increases.

When all 75 characters are used (Fig. 1), the two varieties of $C$. reflexus are separated, and C. ochraceus is questionably placed near C. reflexus var. fraternus.

Table 2. List of the 75 characters and their character states used in the two computerassisted analyses. The first 17 characters are vegetative, and the remaining 58 are reproductive ones. The characters utilized in the "evolutionary" analysis are noted by an asterisk.

| CHARACTER | CHARACTER STATE |
| :---: | :---: |
| *1. habit | annual, 0 ; tufted perennial, 5 ; rhizomatous perennial, 10 |
| 2. height (cm) | actual number (ave.) |
| *3. stem diameter | round, 0 ; roundly triquetrous, 5 ; triquetrous, 10 |
| *4. stem surface | smooth, 0; scabrellate, 10 |
| 5. number of leaves | actual number (ave.) |
| *6. ratio of leaf length to stem length | actual number (ave.) |
| 7. length of leaves (cm) | actual number (ave.) |
| 8. length of leaf sheath (cm) | actual number (ave.) |
| 9. color of leaf sheath | stramineous, 0 ; brown, 5 ; dark red or reddish purple, 10 |
| *10. transverse septa on leaf sheath | absent, 0 ; sparse, 5 ; prominent, 10 |
| 11. width of leaf blade at mid-length (mm) | actual number (ave.) |
| 12. number of involucral bracts | actual number (ave.) |
| *13. nature of involucral bracts | wiry, 0 ; foliaceous, 10 |
| 14. length of involucral bract (cm) | actual number (ave.) |
| 15. width of involucral bract (mm) | actual number (ave.) |
| 16. presence of sheath on involucral bract | absent, 0 ; barely present, 0.5 ; present but inconspicuous, 1.0 |
| 17. transverse septa on involucral bract | absent, 0 ; sparse, 5 ; prominent, 10 |
| 18. length of compound inflorescence (cm) | actual number (ave.) |
| 19. number of primary peduncles | actual number (ave.) |
| 20. length of primary peduncles ( cm ) | actual number (ave.) |
| 21. width of primary peduncles ( mm ) | actual number (ave.) |
| *22. surface of primary peduncles | smooth, 0; prominently scabrellate, 10 |
| 23. number of secondary peduncles | actual number (ave.) |
| 24. length of secondary peduncles (mm) | actual number (ave.) |
| 25. shape of primary heads | cylindrical, 0 ; globose, 5 ; hemispherical, 10 |
| 26. width of primary heads (mm) | actual number (ave.) |
| 27. number of spikelets/primary head | actual number (ave.) |
| 28. number of spikelets/secondary head | actual number (ave.) |
| 29. length of bracteoles (mm) | actual number (ave.) |
| 30. number of veins per bracteole | actual number (ave.) |
| *31. length of prophyll of spikelet (mm) | actual number (ave.) |
| 32. number of veins per prophyll | actual number (ave.) |
| 33. shape of spikelet | oblong, 0 ; broadly ovate, 10 |
| *34. length of spikelet (mm) | actual number (ave.) |
| *35. width of spikelet (mm) | actual number (ave.) |
| *36. number of scales per spikelet | actual number (ave.) |
| 37. width of rachilla (mm) | actual number (ave.) |
| 38. thickness of the rachilla (mm) | actual number (ave.) |
| 39. distance between scale scars (mm) | actual number (ave.) |
| *40. scale angles | actual number (ave.) |
| *41. length of scale (mm) | actual number (ave.) |
| 42. width of scale (mm) | actual number (ave.) |
| 43. width of scale in lateral view (mm) | actual number (ave.) |
| *44. prominence of keels at base of the scale | weak, 0 ; prominent or distinct, 10 |
| 45. length of proximal groove on scale (mm) | actual number (ave.) |
| 46. shape of scale apex | mucronate, 0 ; acute, 3 ; obtuse, 7; round, 10 |
| 47. curvature of scale apex | incurved, 0 ; straight, 5 ; excurved, 10 |
| 48. texture of medial part of scale | firmly membranous, 0 ; subcartilaginous, 10 |
| 49. surface of scales distally | smooth, 0 ; prominently scabrellate, 10 |
| 50. texture of sides of scale | membranous, 0 ; chartaceous, 10 |
| 51. color of sides of scale | stramineous, 0 ; brown, 5 ; reddish black, 10 |
| 52. nature of scale margins | not revolute, 0; revolute, 10 |
| 53. portion of sides of scale attached to rachilla (mm) | actual number (ave.) |
| *54. number of stamens | actual number |
| 55. length of stamens (mm) | actual number (ave.) |
| *56. length of anthers (mm) | actual number (ave.) |

Table 2 (Continued).

| CHARACTER | CHARACTER STATE |
| :--- | :--- |
| 57. pollen diameters $(\mu)$ | actual number (ave.) |
| 58. length of style $(\mathrm{mm})$ | actual number (ave.) |
| 59. length of style branches (mm) | actual number (ave.) |
| *60. portion of scale that achene fills | actual number (ave.) |
| *61. symmetry of achene | asymmetric, $0 ;$ bilateral, $5 ;$ radial, 10 |
| 62. color of achene | stramineous, $0 ;$ brown, $5 ;$ black, 10 |
| 63. angles on the achene | acute, $0 ;$ obtuse, 10 |
| *64. ratio of achene length to width | actual number (ave.) |
| 65. total length of achene (mm) | actual number (ave.) |
| *66. nature of achene base | spongy, $0 ;$ stipitate, 10 |
| 67. length of body of achenes (mm) | actual number (ave.) |
| 68. length of achene beak (mm) | actual number (ave.) |
| 69. relational width of surfaces of achene | unequal, 0;equal, 10 |
| 70. width of achene adaxially (mm) | actual number (ave.) |
| 71. width of achene abaxially (mm) | actual number (ave.) |
| 72. shape of surfaces of achene | obovate, $0 ;$ elliptic, $5 ;$ ovate, 10 |
| 73. nature of adaxial surface of achene | convex, $0 ;$ planar, $5 ;$ concave, 10 |
| 74. nature of abaxial surfaces of achene | convex, $0 ;$ planar, $5 ;$ concave, 10 |
| 75. ease of scale and achene disarticulation | difficult, $0 ;$ easy, 10 |



Figure 1. Dendrogram of the 15 taxa in the Luzulae group using all 75 characters. Abbreviations are as follows: A, C. acuminatus; B, C. distinctus; C, C. eragrostis; D, C. intricatus; E, C. luzulae; F, C. ochraceus; G, C. pseudovegetus var. pseudovegetus; H, C. pseudovegetus var. megalanthus; I, C. reflexus var. reflexus; J, C. reflexus var. fraternus; K, C. surinamensis; L, C. virens var. virens; $\mathrm{M}, C$. virens var. drummondii; $\mathrm{N}, C$. virens var. minarum; $\mathrm{O}, C$. virens var. montanus.

Similarities in the spikelets and the scales account for the clustering of $C$. reflexus var. reflexus, C. intricatus, C. eragrostis, and C. acuminatus. All the varieties of C. virens are positioned near each other, and $C$. surinamensis is nearby.

In the second analysis, six vegetative and 14 reproductive characters were selected as important evolutionary ones. Here the two varieties of C. reflexus diverge together and are distant from the other groups; the rhizomes of these two taxa show a marked difference from the perennating structure of the other taxa. Cyperus eragrostis and $C$. acuminatus are grouped together, largely because of similar fruits and spikelets. Likeness in habit and in stem and leaf structure account for the clustering of $C$. ochraceus with $C$. distinctus. The four varieties of $C$. virens are located near each other, with C. surinamensis as a close relative. Morphologically, C. pseudovegetus var. megalanthus is intermediate between $C$. pseudovegetus var. pseudovegetus and $C$. luzulae; in this dendrogram (Fig. 2), however, var. megalanthus is positioned closer to C. luzulae than it is to var. pseudovegetus.

An analysis of the 17 vegetative characters (Fig. 3) shows a close resemblance to the results provided by the evolutionary characters (Fig. 2). The scabrous nature of the stems and their triquetrous condition probably account for the juxtaposition of $C$. surinamensis and of $C$. intricatus with the varieties of $C$. virens. The two varieties of $C$. reflexus are together but are distant from the other taxa.


Figure 2. Dendrogram of the 15 taxa in the Luzulae group using 20 evolutionary characters. The abbreviations are the same as in Figure 1.


Figure 3. Dendrogram of the 15 taxa in the Luzulae group using 17 vegetative characters. The abbreviations are the same as in Figure 1.

Features of the achenes influenced the results of the dendrogram produced by an analysis of the 58 reproductive characters (Fig. 4). Cyperus acuminatus, C. reflexus var. reflexus, C. eragrostis, and C. virens var. montanus are all placed near each other because all have achenes that are approximately $2-2.5$ times longer than wide. Likewise, C. reflexus var. fraternus is placed in a group which also includes C. virens var. drummondii, C. virens var. minarum, C. virens var. virens, C. surinamensis, and C. ochraceus. This dendrogram is the least useful in the assessment of the relationships of the taxa.

The results of the four analyses are shown by the dendrograms (Figs. 1-4) and by the rank order of characters used in the analyses (Table 3). In all four analyses, only four to seven characters were utilized to differentiate the taxa. Although some variation was expected because different sets of characters were employed in each, there were some consistencies.

The following relationships were affirmed by the study: C. eragrostis and $C$. acuminatus are closer to each other than to any of the other taxa; C. luzulae is closely related to C. pseudovegetus, especially to C. pseudovegetus var. megalanthus; C. ochraceus and $C$. distinctus show a close affinity to each other; and $C$. surinamensis and $C$. intricatus are related to the four varieties of $C$. virens, but together, these six taxa are distantly related to the rest of the taxa. Although reproductive characters are useful in identifying the taxa, these features may not be as important as vegetative


Figure 4. Dendrogram of the 15 taxa in the Luzulae group using 58 reproductive characters. The abbreviations are the same as in Figure 1.

Table 3. Rank order of characters (identified by number) used in discrimination analysis with an associated Wilks Lambda measure in parenthesis.

|  | $\begin{array}{c}\text { CLASSIFICATION BASIS } \\ \text { All 75 }\end{array}$ |  | $\begin{array}{c}\text { 20 Evolutionary } \\ \text { Characters }\end{array}$ |
| ---: | ---: | ---: | ---: |
| Characters |  |  |  |\(\left.\quad \begin{array}{c}17 Vegetative <br>

Characters\end{array}\right)\)
ones in determining evolutionary clades. When all 75 characters were used, only five characters were selected to distinguish the taxa, and three of these were vegetative ones. Likewise, when only 20 characters were selected as evolutionary ones, five characters were discriminators in the analysis, and again, three of these were vegetative ones. The affinities of the taxa shown in Figure 2 appear to be the most reasonable in terms of morphological trends within the Luzulae group. Some of these trends are summarized in Table 4.

Table 4. Characters that are assumed to be "generalized" and "specialized" with regard to the evolution of the Luzulae group of Cyperus.

| GENERALIZED | SPECIALIZED |
| :--- | :--- |
| 1. Compound inflorescence with primary 1. Compound inflorescence with primary, sec- <br> peduncles ondary, and tertiary peduncles or sessile <br> 2. Spikelets up to 16 mm long, with up to 2. Spikelets $20-35 \mathrm{~mm}$ long, with up to 88 <br> 40 scales scales <br> 3. Scales declined $30^{\circ}$ to $60^{\circ}$ from rachilla 3. Scales declined $60^{\circ}$ to $90^{\circ}$ from rachilla <br> 4. Three stamens 4. One stamen <br> 5. Small achenes, $0.6-0.8 \mathrm{~mm}$ long 5. Large achenes, $1.1-1.4 \mathrm{~mm}$ long <br> 6. Stipitate base of achene 6. Swollen spongy and torulose base of achene <br> 7. Ready disarticulation of achenes and scales 7. Tardy disarticulation of achenes and scales <br> 8. Stems roundly triquetrous 8. Stems sharply triquetrous, winged on the <br> 9. Plants perennial angles <br> 10. Tropical distribution 9. Plants annual | 10. Temperate distribution |

## THE LUZULAE GROUP OF CYPERUS

Tufted or rhizomatous herbs with fibrous roots, usually perennials, less commonly annuals; stem solid when young but becoming hollow when the central ground tissue degenerates, mostly erect, rigid, stiff or slightly flexuous, triquetrous to round, often sulcate, smooth or less commonly scabrellate or scabrous, thicker at the base than just below the compound inflorescence; foliage leaves three-ranked, elongate, strap-shaped, arising near the base of the stem, one-half as long to as long as the stem, grayish green, light to dark green or stramineous; leaf sheath generally less than one-third the total length of the leaf, not distinctly differentiated from the blade, sometimes with transverse septa between the veins, occasionally nodulose, often with red unicellular glands adaxially, closed but eventually rupturing in the membranous region opposite the blade and opening to the base, the torn margins erose and easily sloughed off; leaf blade dorsiventral, flat or conduplicate, wiry, coriaceous or sometimes thin and flexuous, the margins antrorsely scabrous (especially on young leaves), the apex acute to attenuate; involucral bracts two to several, spirally arranged, sheathless or with an inconspicuous sheath less than 4 mm long, dorsiventral, flat or conduplicate, elongate, unequal in length with the longer ones surpassing the inflorescence, usually shorter and narrower than the foliage leaves, grayish green, light to dark green or stramineous, sometimes with transverse septa between the veins, occasionally nodulose, the margins often scabrous, apically acute to attenuate; foliage leaves and involucral bracts with epidermal cells often longer and wider on adaxial surfaces than on the abaxial, and with stomates on abaxial (rarely adaxial) surfaces; bracteoles narrowly to broadly ovate, up to 3 mm long, chartaceous or membranous, light green or stramineous, with (three-) five to several reddish veins, the margins entire to scabrellate distally, the midrib minutely scabrellate to scabrous near the acute, attenuate, cuspidate or caudate apex; prophyll of primary or secondary peduncle basally tubular, rounded or truncate distally, up to 16 mm long, membranous to chartaceous, with five to many veins; prophyll of spikelet tubular, rounded to truncate distally, up to 1 mm long, membranous to chartaceous, hyaline, the veins absent or up to seven; compound inflorescence superficially capitate or umbelliform, with closely imbricate spikelets aggregated to form spherical, hemispherical, pyramidal, or cylindrical heads, these sessile or pedunculate; primary peduncles, if present, several, of unequal length, up to 16 cm long, $0.5-1.5 \mathrm{~mm}$ wide, triquetrous to round, erect to spreading, rigid to stiff to flexuous, usually sulcate, glabrous or minutely scabrellate; secondary peduncles arising from the terminal part of the primary ones, of unequal length but shorter than the primary ones, up to 3 cm long, $0.4-1 \mathrm{~mm}$ wide, triquetrous to round, stiff to flexuous, usually sulcate, glabrous or minutely scabrellate, supporting heads with fewer spikelets than those of the primary peduncles; spikelets spirally arranged within compact heads, laterally compressed, ovate, oblong, or linear, 1.5-16 $(-35) \mathrm{mm}$ long, $0.8-4 \mathrm{~mm}$ wide, with (4-) 10-40(-88) distichous scales maturing and subsequently deciduous acropetally as fruits ripen; rachilla tetraquetrous, nearly as long as the spikelet, $0.15-0.50 \mathrm{~mm}$ wide, up to 0.2 mm thick, typically wingless, cartilaginous, straight or arched, persistent, stramineous with a few reddish striations or totally light to dark reddish black, bearing prominently elevated transverse scale scars, these $0.5-0.8 \mathrm{~mm}$ apart on each side; scale angles $30^{\circ}-60^{\circ}\left(-90^{\circ}\right)$; scales boat-shaped, broadly to narrowly ovate, $1-3 \mathrm{~mm}$ long, $0.5-2 \mathrm{~mm}$ wide, 3 -veined, attached basally by the portion between the keels and part or all of the sides, apically rounded, obtuse,
acute, mucronate or cuspidate, distinctly or weakly bicarinate proximally but the two keels merging on the distal one-half to form a single centralized keel, the proximal abaxial groove between the keels $0.8-1.8 \mathrm{~mm}$ long and as wide as the rachilla; medial part of scale usually prominently elevated, thicker than and distinct from the sides and partially visible in lateral view, subcartilaginous or firmly membranous, smooth or scabrellate on the single distal keel, pale green, stramineous, or sometimes golden brown to reddish brown; sides of scale widest just below the middle and generally narrowing toward the base, membranous, chartaceous or crustaceous, reticulate or smooth, translucent or opaque or shiny, light green or yellowish when young but ripening to pale yellow, brown, golden brown, red, reddish brown, or reddish black, the margins straight or partially to completely revolute and clasping the achene; flower solitary in scale axil, bisexual, lacking a perianth; stamens one or two, arising abaxially from the stipitate or spongy base of the ovary; filaments ribbonlike, often hyaline, amber or dull white; anthers basifixed, bilocular, linear, two to five times longer than wide, yellow, with longitudinal dehiscence; pollen spherical, $20-30 \mu$ in diameter, of nearly uniform size for all the included taxa, trinucleate; gynoecium tricarpellate; ovary superior, obtusely to acutely trigonous, unilocular, with basal placentation of the single, erect, anatropous ovule; style trifid, the stigmatic branches light to dark brown, deciduous; achene filling two-fifths to all of the scale, radially or bilaterally symmetric or sometimes asymmetric, narrowly to broadly trigonous, two to seven times longer than wide, $0.8-1.5 \mathrm{~mm}$ long, $0.2-0.6 \mathrm{~mm}$ wide, brown or black, conspicuously or barely stipitate or with a basal white to brown spongy and torulose parenchymatous tissue 0.2 mm long and as wide as the achene, apically narrowed to a slender beak continuous with the style and $0.1-0.5 \mathrm{~mm}$ long; achenial surfaces usually puncticulate, of equal or slightly differing width, elliptic, ovate or obovate, planar or slightly concave (seldom convex), often covered with a tardily deciduous single layer of translucent or often iridescent cells; embryo embedded in abundant endosperm.

## DIRECTIONS FOR USE OF KEY

1) The height of the plant is measured from the base of the stem to the base of the involucral bracts.
2) The proportion of the scale filled by the achene should be measured or estimated while the achene is still enclosed by the scale.
3) The width of the scale in lateral view can be observed by noting the lateral compression of the spikelet; part of the subcartilaginous middle part of the scale will be evident as well as the membranous or crustaceous side of the scale.
4) The proximal abaxial groove of the scale is located between the two basal keels and extends toward the apex; the length of the groove can usually be measured while the scale is still attached to the rachilla.
5) The scale angle is the angle of declension of the scale from the rachilla.
6) Measurements of scales, stamens, and achenes should be made near the base of the spikelet where these structures are most likely to be mature.

## KEY TO THE LUZULAE GROUP OF CYPERUS

[^0]3. Stems round to triquetrous, scabrellate generally over the surface (not just on the angles); leaf blades and involucral bracts smooth or with inconspicuous and sparse septa between the veins, weakly nodulose; stamen solitary; annuals or delicate perennials, usually less than 60 cm tall.
4. Achenes narrowly trigonous, ca three times longer than wide; scales $1-1.5 \mathrm{~mm}$ long, the sides translucent, membranous and usually pale yellow or light brown (rarely reddish brown), the apices straight (or subtly excurved); tufted perennials; North and South America.
C. surinamensis.
4. Achenes broadly trigonous, $2-2.5$ times longer than wide; scales ( $1.2-$ ) $1.5-2 \mathrm{~mm}$ long, the sides opaque (or shiny), usually papyraceous, and yellow, brown, or reddish brown, the apices usually excurved; tufted annuals, rarely perennials; North America.
C. acuminatus.
3. Stems triquetrous and scabrous on the acute and often winged angles; leaf blades and involucral bracts usually with conspicuous septa between the veins, nodulose; stamens one or two; sturdy perennials of ten more than 60 cm tall.
5. Scales $2-3 \mathrm{~mm}$ long, straight or inwardly arched, the sides red, reddish black, reddish brown, or light brown.
6. Spikelets $4-6 \mathrm{~mm}$ long, $3.5-4 \mathrm{~mm}$ wide; scales $2-3 \mathrm{~mm}$ long, $0.5-0.8 \mathrm{~mm}$ wide in lateral view, the sides dark red, dark reddish black, or brown; primary peduncles up to 8 cm long; South America.
C. intricatus.
6. Spikelets (5-) $7-15 \mathrm{~mm}$ long, $2-3.3 \mathrm{~mm}$ wide; scales $2-2.4 \mathrm{~mm}$ long, $0.4-0.6 \mathrm{~mm}$ wide in lateral view, the sides brown; primary peduncles up to 14 cm long; North and South America. C. virens var. virens.
5. Scales $1-2 \mathrm{~mm}$ long, straight, the sides brown to light reddish brown.
7. Scales $1-1.5(-1.8) \mathrm{mm}$ long; spikelets $1.5-2.2(-2.5) \mathrm{mm}$ wide; primary peduncles $2-5(-6)$, usually up to $2(-4) \mathrm{cm}$ long; leaf blades $3-5(-7) \mathrm{mm}$ wide at mid-length; achenes filling seven-eighths of the scales.
C. virens var. drummondii.
7. Scales $1.5-2 \mathrm{~mm}$ long; spikelets (2-) $2.2-3.3 \mathrm{~mm}$ wide; primary peduncles $6-15$, up to 12 cm long; leaf blades (4-) $7-14 \mathrm{~mm}$ wide at mid-length; achenes filling one-half to three-fourths of the scales.
8. Achenes (1-) $1.2-1.5 \mathrm{~mm}$ long, (2.5-) 3-5 times longer than wide, obtusely angled, the surfaces usually planar or sometimes concave; spikelets (5-) $7-15 \mathrm{~mm}$ long.
C. virens var. virens.
8. Achenes $1-1.2 \mathrm{~mm}$ long, $2-2.5$ times longer than wide, acutely or obtusely angled, the surfaces (or at least the two abaxial ones) concave; spikelets $5-10 \mathrm{~mm}$ long.
9. Spikelets $7-10 \mathrm{~mm}$ long, $3-3.6 \mathrm{~mm}$ wide; achenes filling one-half to twothirds of the scales, acutely angled, slightly concave on the adaxial surface; scales $0.3-0.5(-0.8) \mathrm{mm}$ wide in lateral view, generally brown; primary peduncles up to 10 cm long; secondary peduncles up to 4 cm long; tertiary peduncles up to 1 cm long; involucral bracts up to 12 mm wide; South America. C. virens var. montanus.
9. Spikelets $5-6.5 \mathrm{~mm}$ long, $2.2-2.5 \mathrm{~mm}$ wide; achenes filling two-thirds or more of the scales, obtusely angled, usually planar on the adaxial surface; scales $0.5(-0.8) \mathrm{mm}$ wide in lateral view, generally reddish brown; primary peduncles up to 7 cm long; secondary peduncles, when present, up to 2 cm long; tertiary peduncles absent; involucral bracts up to 5 mm wide; North and South America.
C. virens var. minarum.
2. Stems smooth.
10. Involucral bracts with the primary and longest bract wiry, $\pm$ erect (sometimes reflexed by a nearly sessile and large head), and appearing like a prolongation of the stem, up to 3 mm wide; scales $1-2(-2.2) \mathrm{mm}$ long; stamen solitary; scaly rhizomes usually evident.
11. Achenes $2-2.5$ times longer than wide; scales usually falcate in lateral view, the sides reticulate when mature, the apices usually excurved (seldom straight); tufted annuals or short-lived perennials; North America.
C. acuminatus.
11. Achenes $2.5-3$ times longer than wide; scales $\pm$ triangular in lateral view, the sides typically smooth and glossy when mature, the apices straight or slightly excurved; rhizomatous perennials; North and South America.
C. reflexus.
12. Achenes filling two-fifths to three-fifths of the scales, broadly trigonous, usually 2.5 times longer than wide, the surfaces generally concave; scales (1-) $1.5-1.8$ $(-2.1) \mathrm{mm}$ long, the sides red and shiny.
C. reflexus var. reflexus.
12. Achenes filling three-fifths to three-fourths of the scales, narrowly trigonous, usually three times longer than wide, the surfaces planar (only slightly if at all concave); scales $1.5-2 \mathrm{~mm}$ long, the sides usually light brown and either shiny or dull. C. reflexus var. fraternus
10. Involucral bracts typically foliaceous, spreading to reflexed, (1-) $3-12 \mathrm{~mm}$ wide; scales $1-3 \mathrm{~mm}$ long; stamens one or two; scaly rhizomes absent or short.
13. Achenes broadly trigonous, $2-2.5$ times longer than wide.
14. Annuals up to $30(-46) \mathrm{cm}$ tall; spikelets $4-7 \mathrm{~mm}$ long; scales (1.2-) 2 mm long, the apices usually excurved (seldom straight); rachillas $0.15-0.2 \mathrm{~mm}$ wide; achenes $0.8-1.1 \mathrm{~mm}$ long, the surfaces $0.3-0.4 \mathrm{~mm}$ wide; North America.

## C. acuminatus.

14. Perennials up to 90 cm tall; spikelets $4-20(-35) \mathrm{mm}$ long; scales $1.5-3 \mathrm{~mm}$ long, the apices straight or incurved (rarely excurved); rachillas $0.3-0.5 \mathrm{~mm}$ wide; achenes $1-1.5 \mathrm{~mm}$ long, the surfaces $0.4-0.6 \mathrm{~mm}$ wide; North and South America.
15. Scale angles $\left(45^{\circ}-\right) 60^{\circ}-90^{\circ}$ for mature scales; scales (1.2-) $1.5-2 \mathrm{~mm}$ long, the proximal abaxial grooves $0.6-1.5 \mathrm{~mm}$ long, the apices incurved or straight; achenes obtusely angled, filling two-thirds to three-fourths of the scales, the surfaces convex or planar; involucral bracts $2-6 \mathrm{~mm}$ wide.

> C. ochraceus.
15. Scale angles $30^{\circ}-45^{\circ}$ for mature scales; scales (1.5-) $2-3 \mathrm{~mm}$ long, the proximal abaxial grooves $0.3-0.6(-0.8) \mathrm{mm}$ long, the apices straight (rarely excurved); achenes acutely angled, filling two-fifths to three-fifths of the scales, the surfaces slightly concave; involucral bracts $1.5-12 \mathrm{~mm}$ wide.
16. Scales $1.5-2(-2.4) \mathrm{mm}$ long, the margins brown; secondary peduncles up to 4 cm long; stems acutely triquetrous; refer to varieties under leads 5-9.
C. virens.
16. Scales $2-3 \mathrm{~mm}$ long, the margins reddish brown, reddish black, dark red or brown; secondary peduncles up to 2 (rarely to 3 ) cm long; stems round to triquetrous.
17. Spikelets $5-20 \mathrm{~mm}$ long; scales $2-2.3 \mathrm{~mm}$ long, $0.3-0.6 \mathrm{~mm}$ wide in lateral view, smooth or minutely scabrellate distally, the sides brown to golden brown; achenes ca two times longer than wide; stamen solitary; North and South America.
C. eragrostis.
17. Spikelets $4-6 \mathrm{~mm}$ long; scales $2-3 \mathrm{~mm}$ long, $0.5-0.8 \mathrm{~mm}$ wide in lateral view, prominently scabrellate distally (rarely smooth), the sides red, reddish black, reddish brown, or light brown; achenes 2.5-4 times longer than wide; stamens (one or) two; South America. C. intricatus.
13. Achenes narrowly trigonous, (2.5-) 3-7 times longer than wide.
18. Scales $1-1.5(-2) \mathrm{mm}$ long; achenes $0.8-1(-1.2) \mathrm{mm}$ long.
19. Sides of scales translucent and either pale yellow or light brown (seldom reddish brown); scales $1-1.5 \mathrm{~mm}$ long, the apices acute and straight (or subtly excurved); spikelets with (10-) $20-58(-72)$ scales. C. surinamensis.
19. Sides of scales opaque (or shiny), and dull white, stramineous, golden brown, or reddish brown; scales $1-2 \mathrm{~mm}$ long, the apices rounded to acute and either incurved or straight or excurved; spikelets with (4-) 6-40 scales.
20. Scales $1-1.5(-2) \mathrm{mm}$ long, the sides dull white, stramineous or light brown, the apices rounded to acute and either incurved or straight; spikelets $0.8-2.2 \mathrm{~mm}$ wide; involucral bracts $7-12$, up to 70 cm long; leaf blades $5-12 \mathrm{~mm}$ wide; achenes $0.9-1(-1.2) \mathrm{mm}$ long.
C. luzulae.
20. Scales $1.5-2 \mathrm{~mm}$ long, the sides yellowish brown or reddish brown, the apices acute to cuspidate and slightly excurved (sometimes straight); spikelets $1.5-3 \mathrm{~mm}$ wide; involucral bracts $3-8$, up to 50 cm long; leaf blades (1-) 4-6 ( -8 ) mm wide; achenes $1-1.3(-1.5) \mathrm{mm}$ long.
21. Scale angles ca $45^{\circ}$ for mature scales; stems acutely triquetrous; scales $0.4-0.6 \mathrm{~mm}$ wide in lateral view, the apices straight; achenes $2-5$ times longer than wide, the surfaces often unequal in width; stamens one or two; refer to varieties under leads 5-9.
C. virens.
21. Scale angles $20^{\circ}-30^{\circ}\left(-45^{\circ}\right)$ for mature scales; stems round to roundly triquetrous; scales $0.2-0.3 \mathrm{~mm}$ wide in lateral view, the apices slightly excurved; achenes 5-7 times longer than wide, the surfaces $\pm$ equal in width; stamen solitary.
C. pseudovegetus var. pseudovegetus.
18. Scales $2-3 \mathrm{~mm}$ long; achenes $1-1.5 \mathrm{~mm}$ long.
22. Scales $2-3 \mathrm{~mm}$ long, $0.5-0.8 \mathrm{~mm}$ wide in lateral view, prominently scabrellate distally (rarely smooth), the apices straight; stamens (one or) two; achenes 2.5-4 times longer than wide; South America. C. intricatus.
22. Scales $2-2.5 \mathrm{~mm}$ long, $0.2-0.3 \mathrm{~mm}$ wide in lateral view, barely scabrellate distally, the apices usually excurved; stamen solitary; achenes 4-7 times longer than wide; North America. C. pseudovegetus.
23. Involucral bracts $4-8$, up to 4 mm wide; spikelets $1.5-3 \mathrm{~mm}$ wide; scales $1.5-2.2 \mathrm{~mm}$ long, the proximal abaxial groove $0.8-1 \mathrm{~mm}$ long; scale angles $20^{\circ}-30^{\circ}\left(-45^{\circ}\right)$; achenes filling ca three-fourths of the scales.
C. pseudovegetus var. pseudovegetus.
23. Involucral bracts (5-) $8-18(-40)$, up to 9 mm wide; spikelets $3-4 \mathrm{~mm}$ wide; scales $2-2.5 \mathrm{~mm}$ long, the proximal abaxial groove $1.2-1.5 \mathrm{~mm}$ long; scale angles $30^{\circ}-45^{\circ}$; achenes filling ca one-half of the scales.
C. pseudovegetus var. megalanthus.

Cyperus acuminatus Torrey \& Hooker, Ann. Lyceum Nat. Hist. New York 3: 435. 1836. Type: United States, Missouri, St. Louis, Drummond s.n. (K!, lectotype; NY!, isolectotype). Figure $5(\mathrm{E}-\mathrm{H})$.

Cyperus cyrtolepis Torrey \& Hooker, Ann. Lyceum Nat. Hist. New York 3: 436. 1836. Type: United States, Texas, Rio Brazos, 1835, Drummond 450 (NY!, lectotype; B!, K!, isolectotypes).

Cyperus cyrtolepis Torrey \& Hooker var. caespitosus Böckeler, Linnaea 35: 558. 1868, nom. illegit. Type: Drummond 450, which is the type of C. cyrtolepis.

Cyperus rufescens Torrey \& Hooker var. denticarinatus Britton, Bull. Torrey Bot. Club 11: 85. 1884. Type: Valley of the Rio Grande, in Texas and northern Mexico, 1879-1883, S. B. Buckley s.n. (NY!, holotype).

Cyperus cyrtolepis Torrey \& Hooker var. denticarinatus (Britton) Britton, Bull. Torrey Bot. Club 13: 209. 1886.

Cyperus acuminatus Torrey \& Hooker var. cyrtolepis (Torrey \& Hooker) Kukenthal, Pflanzenreich IV. 20 (Heft 101): 178. 1936.

Tufted annual or sometimes short-lived perennial, up to $30(-46) \mathrm{cm}$ tall; stems mostly erect, somewhat flexuous, roundly triquetrous, usually smooth or seldom scabrellate on the upper one-half, grayish green or stramineous, $0.4-1 \mathrm{~mm}$ wide distally, $0.7-1.2 \mathrm{~mm}$ wide at the base; leaves $2-8$, one-half as long as the stem, $8-17$ ( -35 ) cm long; leaf sheath $2-12 \mathrm{~cm}$ long, light green to light brown, rarely reddish brown, with sparse transverse septa between the veins, occasionally persistent and becoming darker brown and partially fibrous the second year; leaf blade 1-2.5 $(-4.5) \mathrm{mm}$ wide at mid-length, flat or conduplicate, grayish green or stramineous, acute at apex; involucral bracts $3-6$, usually foliaceous and spreading but sometimes the lowermost and longest bract wiry, stiff, $\pm$ erect, and appearing like a prolongation of the stem, up to 31 cm long, up to 3.8 mm wide, sheathless, flat or conduplicate, grayish green or stramineous, lacking transverse septa between the veins, apically acute; compound inflorescence $2-8 \mathrm{~cm}$ long; primary peduncles $1-3(-5)$, up to 2 cm long; $0.5-1 \mathrm{~mm}$ wide, roundly triquetrous, smooth, slightly flexuous; secondary peduncles absent or $1-3$, up to 2 cm long, ca 0.5 mm wide, straight or slightly flexuous; heads hemispherical, the primary ones $7-17 \mathrm{~mm}$ wide and with (12-) $20-75$ spikelets, the secondary ones $7-12 \mathrm{~mm}$ wide and with (8-) $20-40$ spikelets; bracteoles narrowly ovate, $2.5-5 \mathrm{~mm}$ long, $3-5$-veined, chartaceous, apically cuspidate to caudate; prophyll of spikelet $0.5-1 \mathrm{~mm}$ long, membranous and hyaline, the veins 3 or absent; spikelets ovate, $4-7 \mathrm{~mm}$ long, $2-3 \mathrm{~mm}$ wide, apically acute, with $8-26(-42)$ scales; rachilla $0.15-0.2 \mathrm{~mm}$ wide, ca 0.5 mm thick, straight, adaxially stramineous or with a few red to reddish-brown glandular longitudinal striations, the transverse scale scars $0.5-0.6 \mathrm{~mm}$ apart on each side; scale angles $30^{\circ}-45^{\circ}$; scales (1-) $1.3-2 \mathrm{~mm}$ long, $1-1.2(-1.5) \mathrm{mm}$ wide, or $0.4-0.5 \mathrm{~mm}$ wide and falcate in lateral view, usually with a few yellow or red glands adaxially, apically acute to cuspidate and usually excurved, seldom straight, distinctly bicarinate basally, the proximal abaxial groove between the


Figure 5. A-D. Cyperus ochraceus (based on Dieterle 4256); A, inflorescence, $\times 1 / 2$; B, spikelet, $\times 5 ; \mathrm{C}$, scale, $\times 17.5 ; \mathrm{D}$, achene, $\times 17.5$. E-H. Cyperus acuminatus (based on Eggert 351); E, inflorescence, $\times 1 / 2$; F, spikelet, $\times 5$; G, scale, $\times 17.5$; H, achene, $\times 17.5$. I-L. Cyperus eragrostis (based on Bartlett 19266); I, inflorescence, $\times 1 / 2$; J, spikelet, $\times 5$; K, scale, $\times 17.5$; L, achene, $\times 17.5$.
two keels $0.3-0.4 \mathrm{~mm}$ long; medial part of scale firmly membranous or subcartilaginous, green or light brown, barely scabrellate distally; sides of scale membranous to chartaceous and reticulate with conspicuous cells, light green, yellow, brown or light reddish brown, the margins revolute on the lower two-fifths especially where the scale narrows and encloses the achene, basally attached to the rachilla for ca 0.1 mm , leaving at least 0.1 mm free on each side; stamen solitary, $1.5-2 \mathrm{~mm}$ long, the filament $1-1.5 \mathrm{~mm}$ long, the anther $0.5(-0.7) \mathrm{mm}$ long; pollen $25-30 \mu$ in diameter; style ca 1 mm long, the stigmatic branches ca 0.5 mm long; achene filling two-fifths to three-fifths of the scale, radially or slightly bilaterally symmetric, brown, broadly trigonous, acutely angled, two to two and one-half times longer than wide, $0.7-1.1 \mathrm{~mm}$ long (total length), the stipitate base less than 0.1 mm long, the body $0.5-0.9 \mathrm{~mm}$ long, and the slender apical beak $0.1-0.2 \mathrm{~mm}$ long; achenial surfaces of equal width, $0.3-0.4 \mathrm{~mm}$ wide, slightly obovate or elliptic, usually planar (seldom convex) adaxially, scarcely concave abaxially.

Distribution. Virginia south to Alabama and west to North Dakota, Colorado and Texas, and in Washington, Oregon, and California; in Mexico, only from Coahuila. Found in open pastures, swales, low moist depressions, moist sandy ditches, or salt flats in clayey, loam or limestone soils at elevations usually up to 430 meters, but as high as 2000 meters in Mexico (Fig. 6).

Discussion. Typically an annual with a shallow, fibrous root system, this species may persist as a perennial for two or more years in the southern limit of its distribution. The stems are characteristically triquetrous and glabrous, but a few specimens (mostly from Texas, and a few isolated collections from Nebraska and Minnesota) have stems that are scabrellate distally.

The scales and achenes are the basic features for distinguishing this taxon. The scales are generally membranous, with conspicuous reticulate cells and with strongly


Figure 6. Distribution of Cyperus acuminatus and C. distinctus.
excurved apices. As the scales mature, the texture becomes firmer, the apices arch outwardly, and the color may intensify as light green, yellow, brown, or light reddish brown. The length of the scale may vary by 0.5 mm on a single individual or by 1 mm for the species as a whole. Mostly, the scales are $1.5-2 \mathrm{~mm}$ long and falcate in lateral view; exceptions may be found on specimens from Cameron County, Texas, where the scales are $1-1.5 \mathrm{~mm}$ long and tend to be triangular in lateral view, the apices scarcely (if at all) excurved. The broadly trigonous achenes are two to two and one-half times longer than wide and consistently fill two-fifths to three-fifths of the scales.

Cyperus acuminatus has sometimes been confused with C. reflexus var. reflexus and with C. surinamensis because of similarities in size and habit, but all of these taxa differ with respect to features of the scales and achenes. All three occur in Texas, and C. acuminatus and C. surinamensis overlap in geographic distribution throughout much of the southeastern United States.

Hybridization between C. acuminatus and C. surinamensis or C. reflexus may create some of the morphologically intermediate plants that exist in Texas, but this still needs to be documented. Some of the variants suggest C. acuminatus except for the scabrellate stems that are typical for C. surinamensis, while others have scales that are similar in texture and shape to $C$. acuminatus but similar in color pattern to $C$. reflexus; these variants and their putative parents have broadly trigonous achenes (as in C. acuminatus and C. reflexus var. reflexus) and may have the lowermost involucral bract stiff, erect, and elongate. One of the intermediate collections serves as the type of $C$. rufescens var. denticarinatus, considered here as a synonym.

Representative specimens:
UNITED STATES OF AMERICA: VIRGINIA: ROANOKE CO: ca 1.6 mi SW of Salem P. O., 11 Aug 1942, Wood, Jr. 5017 (GH).

OHIO: ROSS CO: near Delano Station, 16 Aug 1939, Bartley \& Pontius 762 (DUKE, NY). KENTUCKY: no locality, 1859, Short s.n. (UC).
TENNESSEE: RUTHERFORD CO: Lavergne, 12 Aug 1922, Svenson 209 (GH).
ALABAMA: LIMESTONE CO: Wheeler Reservoir, 3 June 1944, Isely 3451 (TEX).
ILLINOIS: ADAMS CO: Camp Point, Sep 1878, Seymour s.n. (DUKE). CHAMPAIGN CO: Urbana, 28 Sep 1909, Pease 12487 (GH); Mayview, 6 Oct 1907, Gates 2359 (MICH). HENDERSON CO: banks of the Mississippi near Oquawka, 21 Aug 1873, Patterson s.n. (CAS, GH, MICH, MO, NY, UC). JERSEY CO: Kemper, Sep 1904, McDonald s.n. (GH). MACON CO: Decatur, 8 June 1899, Clokey 1080 (UC). MCDONOUGH CO: S of Bushnell, 2 Sep 1950, Chase 11500 (UC). PEORIA CO: Sec. 10, Medina Twp., 27 Sep 1952, Chase 13097 (DS, NY, UC). STARK CO: ditch near Wady Petra, 5 Aug 1898, Chase 153 (LY), 18 July 1900, Chase 682 (LY, MO).

MINNESOTA: NICOLLET CO: 3-4 mi W of Courtland, 27 Aug 1947, Moore \& Huff 19782 (GH). PIPESTONE CO: Sioux quartzite $1 / 2$ mi N of Pipestone, 15 Sep 1938, Moore \& Moore 10549 (DUKE, GH, NY, TEX, UC).

IOWA: JEFFERSON CO: Collett, 1897, Baldwin 455 (GH, MO). WOODBURY CO: Sioux City, 18 _, Hitchcock s.n. (MO).

MISSOURI: JASPER CO: Neck, 2 Oct 1910, Palmer 3229 (BM); Joplin, 19 June 1909, Palmer 2264 (BM); Neck City, 16 Aug 1919, Palmer 2784 (GH). LINN CO: 4 mi SW of Laclede, 26 June 1941, Steyermark 40435 (GH). MCDONALD CO: Anderson, 24 July 1892, Bush s.n. (MO). ST. LOUIS CO: near St. Louis, no date, Glatfelter 92 (MICH); Forest Park, 21 Sep 1875, Eggert s.n. (B, C, M, NY, TO); St. Louis, Eggert 351 (MICH); St. Louis, "from type locality," Sep 1845, Engelmann s.n. (BM, TEX). SHANNON CO: no locality, 22 July 1891, Bush s.n. (MO).

ARKANSAS: CARROLL CO: Beaver, 24 July 1914, Palmer 6365 (MO). MILLER CO: Mandeville, 10 June 1898, Eggert s.n. (MO). PULASKI CO: bottomlands, 4 June 1885, Hasse s.n. (M); Little Rock, June 1886, Hasse s.n. (DS). ST. FRANCIS CO: swampy regions around Black Fish Lake, 13 June 1935, Demaree 11407 (DS, WTU). WASHINGTON CO: Fayetteville, 6 July 1915, Palmer 8173 (CAS, MO).

LOUISIANA: CADDO PARISH: ca 3 mi NW of Keithville, 7 July 1970, Thieret 32114 (DUKE). MOREHOUSE PARISH: 9 mi SE of Haile, 1 July 1968, Thieret 29857 (DUKE, LL). OUACHITA PARISH: ca 7 mi SW of West Monroe, 9 June 1964, Kral 20342 (UC).

NORTH DAKOTA: BENSON CO: Leeds, 24 Aug 1901, Lunell s.n. (DS, GH). CASS CO: Fargo, 14 Aug 1942, Stevens 651 (MO, UC).

SOUTH DAKOTA: BROWN CO: Aberdeen, 25 Sep 1897, Griffiths 859 (GH). CUSTER CO:

Black Hills, Custer, 16 July 1892, Rydberg 1068 (K). MELLETTE CO: 4 mi E of Mellette, 9 Mar 1944, Brenckle 4303 (B, GH, NY, TEX), 12 Aug 1943, Brenckle 43-03 (CAS).

NEBRASKA: CHASE CO: near Enders, 9 Aug 1941, Tolstead 4183 (UC); near Lamar, 4 Aug 1941, Tolstead 4184 (UC). CLAY CO: 3 mi S of Clay Center, 15 Aug 1941, Tolstead 41823 (UC); 3 mi SE of Fairfield, 5 July 1941, Tolstead 4182 (MO.) DODGE CO: nr Waterloo, 16 July 1941, Tolstead 4187 (DUKE, MO, UC). FILLMORE CO: Fairmont, 1 mi W, 15 Aug 1944, Kiener 17141 (UC), 17155 (TEX); 2 mi NW of Shickley, 8 July 1941, Tolstead 4189 (TEX). FRANKLIN CO: 6 mi N of Franklin, 14 Aug 1941, Tolstead 4190 (UC). HALL CO: near Grand Island, 28 Aug 1943, Kiener 15166 (GH). HAMILTON CO: near Aurora, 21 July 1941, Tolstead 4192 (DUKE, UC). HOLT CO: 20 mi S of O'Neill, 20 Aug 1941, Tolstead 4195 (UC). KEARNEY CO: Minden, 3 Aug 1920, Hapeman s.n. (DS, MICH), 24 Aug 1930, Hapeman s.n. (DS, MICH, TEX). KEITH CO: near Kingsley Dam, 22 Sep 1943, Kiener 15581 (TEX). NUCKOLLS CO: nr Superior, 16 Sep 1941, Tolstead s.n. (UC). OTOE CO: SE of Syracuse, 23 Aug 1946, Kiener 21452 (TEX). PERKINS CO: N of Grant, 5 Sep 1943, Kiener 15288 (GH, TEX); 2 mi E of Grant, 2 Aug 1941, Tolstead 4198 (MO, UC). PHELPS CO: S of Holdrege, 10 Sep 1941, Tolstead 4199 (UC), 23 July 1941, 4199 (MO). RICHARDSON CO: swamp NW of Stella, 15 July 1940, Reynolds 1769 (UC). SALINE CO: 2 mi S of Dorchester, 11 July 1941, Tolstead 41101 (UC). WEBSTER CO: 10 mi NW of Red Cloud, 14 Sep 1941, Tolstead 41102 (UC). YORK CO: York, 23 Aug 1943, Kiener 15005 (GH).

KANSAS: COFFEY CO: about $1 / 2 \mathrm{mi}$ E of Waverly, no date, Henderson 66-670 (CAS). HARVEY CO: 4 mi N of Burrton, 19 Aug 1939, Horr E286 (B, GH, L, TEX, UC). LANE CO: about 1 mi W of Dighton, 15 Sep 1967, Henderson 67-1776 (CAS). WOODSON CO: $1 / 2 \mathrm{mi} \mathrm{E}$ of Yates Center, 7 July 1955, Lathrop 1224 (UC).

OKLAHOMA: BRYAN CO: Durant, 20 Oct 1947, Stratton 6728 (GH); Rock Creek, Lake Texoma, 28 Sep 1949, Bonn 51-444 (TEX). CARTER CO: 5 mi E of Ardmore, 31 Oct 1942, Hopkins 6333 (BM). COMANCHE CO: Caddo Lake, western edge of Wichita Mts Wildlife Refuge, 27 July 1967, Crutchfield 3624 (LL); Fort Sill, 14 June 1916, Clemens 11507 (GH). CRAIG CO: 10 mi N of Vinita, 19 June 1938, Goodman 3043 (GH, UC, WTU). CREEK CO: Sapulpa, "Indian Territory," 30 July 1894, Bush 616 (BM). GARFIELD CO: $11 / 2 \mathrm{mi} \mathrm{N}$ of Breckinridge, 7 June 1941, Gerhardt 413 (B). KAY CO: nr Toukawa, 5 Aug 1913, Stevens 1889 (GH). LOVE CO: Lake Murray, 26 Sep 1970, Correll \& Correll 40034 (LL). MAYES CO: below dam at Disney, 11 Aug 1965, Correll \& Correll 31361 (LL). MCCURTAIN CO: N of Broken Bow, 19 July 1967, Mitchell 3310 (LL). NOBLE CO: Perry, 27 June 1896, Greiner s.n. (DUKE). OTTAWA CO: Picher, 18 Sep 1970, Correll \& Correll 39827 (LL). PAYNE CO: Stillwater, 6 June 1916, Learn 30 (UC). POTTAWATOMIE CO: 5 mi W of A sher, 29 June 1958, Goodman 6643 (UC). WASHINGTON CO: near Copan, 15 Aug 1913, Stevens 2113 (DS, GH).

TEXAS: BANDERA CO: 2 mi N of Vanderpool, 17 July 1957, Correll \& Johnston 18151 (LL). BASTROP CO: 2 mi SE of Cedar Creek, 3 May 1956, McCart 5702 (DUKE, GH, TEX). BELL CO: 3 mi S of Temple, 9 Aug 1929, Wolff 1084 (WTU). BEXAR CO: San Antonio, 4 May 1911, Clemens 413 (UC); 15 mi NW of San Antonio, 18 Nov 1931, Metz 235 (L, NY, WTU). BRAZORIA CO: Brazoria Nat'l Wildlife Refuge, 29 Mar 1967, Fleetwood 9013 (TEX), 25 Aug 1967, $9113 a$ (TEX). BRAZOS CO: 6 mi NE of Benchley, 17 Nov 1940, Curry 18 (CAS). BROWN CO: Brownwood, 19 June 1966, Ewing 54 (LL, TEX). BURNET CO: Granite Mt., 25 July 1946, Barkley \& Johnson 6078 (TEX); 2 mi E of Burnet, 25 May 1966, Crutchfield 1589 (LL). CALDWELL CO: no locality, 13 July 1943, Barkley 13132 (MO, TEX, UC). CAMERON CO: near Brownsville, 6 May 1923, Standley 713 (TEX); Laguna Atascosa Refuge, 21 Sep 1961, Fleetwood 3815 (TEX); 20 mi N of Brownsville, 2 July 1941, Runyon 2805 (TEX, UC). COMAL CO: Comanche Springs, New Braunfels, July 1849, Lindheimer 1235 (BM, C, K, M, NY, TEX, UC). COOKE CO: 6 mi SW of Sivels Bend, 16 July 1967, Crutchfield 3441 (LL). DALLAS CO: South Dallas, 27 June 1899, Eggert s.n. (BM); between Elam \& Seagoville, 8 July 1944, Lundell \& Lundell 13804 (LL). DENTON CO: Lake Dallas Fish Hatchery, 15 Aug 1939, McCart 1817 (MICH). ELLIS CO: $3 / 4 \mathrm{mi} \mathrm{S}$ of Ferris, 10 July 1946, Cory 53358 (DS, MICH, NY, UC). ERATH CO: 2 mi NE of Stephenville, 26 June 1950, Gould 5660 (TEX, UC). GILLESPIE CO: just N of Fredericksburg, 29 June 1957, Correll \& Johnston 17265 (ENCB, LL). GONZALES CO: 7 mi S of Gonzales, 6 July 1957, Correll \& Johnston 17501 (LL, UC). HARRIS CO: Highlands, 12 Aug 1966, Mears 686 (TEX); Houston, 13 July 1937, Fisher s.n. (UC). HIDALGO CO: near Mission, 13 July 1941, Runyon 2634 (TEX); Mercedes, 21 Apr 1933, Clover 949 (DS). JACKSON CO: 13 mi E of Edna, 11 Nov 1958, Hotchkiss 7658 (LL). JEFF DAVIS CO: 18 mi N of Alpine, 1 Oct 1950, Warnock 9797 (LL). JIM HOGG CO: 20 mi S of Mirando City, 21 Apr 1962, Sanchez et al. 8302 (TEX). JIM WELLS CO: 5.7 mi S of Alice, 24 Nov 1954, Johnston 542095 (TEX). KAUFMAN CO: $31 / 4 \mathrm{mi}$ W of Forney, 14 July 1946, Cory 53266 (DS, MICH, NY, UC, WTU). KLEBERG CO: near Kingsville, 9 Apr 1933, Clover 838 (MICH). LAMAR CO: 5 mi N of Paris, 5 June 1961, Johnston 6269 (LL). LAMPASAS CO: Lampasas, June 1885, Reverchon 3588 (BM, GH, UC). LLANO CO: 6 mi W of Llano, 5 Oct 1933, Cory 6361 (GH). MCLENNAN CO: McLennan, 30 June 1947, Smith 815 (TEX). NUECES CO: Corpus Christi, 14 May 1915, Young 5 (UC). PALO

PINTO CO: Strawn, 27 June 1918, Palmer 14259 (B, MO). PARKER CO: Weatherford, 6 June 1902, Tracy 7967 (BM, TEX). PRESIDIO CO: near Vieja Pass, 16 July 1941, Hinckley 1996 (TEX). REFUGIO CO: 9 mi W of Refugio, 16 June 1957, McCart 6839 (DUKE). ROCKWALL CO: $11 / 4 \mathrm{mi}$ NE of Rockwall, 26 June 1946, Cory 53321 (MICH, UC). SAN SABA CO: 20 mi S of Richland Springs, 7 June 1966, McCart \& McMillan 22 (LL, TEX). STEPHENS CO: Blackman's Lake, 22 June 1941, Tharp s.n. (B, TEX, UC). TARRANT CO: Tarrant, 1 Aug 1940, McCart 2118 (TEX). TAYLOR CO: Lake Lytle nr Abilene, 13 June 1943, Tolstead 7434 (GH, MICH, UC). TRAVIS CO: near Barton Springs Creek, 23 July 1943, Barkley 13395 (B, TEX); W of Austin, 3 May 1921, Tharp 1023 (TEX). UVALDE CO: Uvalde, 14 Oct 1916, Palmer 11032 (DS, MO). VAL VERDE CO: 11.1 mi NW Del Rio, 30 Aug 1965, Kral 25786 (ENCB). WEBB CO: about 19 mi S of Catarina, 7 June 1945, Lundell \& Lundell 13803 (LL, TEX). WICHITA CO: $41 / 2 \mathrm{mi} \mathrm{N}$ and $1 / 2 \mathrm{mi} \mathrm{W}$ of Iowa Park, 30 Sep 1960, Mahler 1402 (TEX); Wichita Falls, 1926, McKee s.n. (TEX). WILLACY CO: Raymondville, 18 Apr 1941, Runyon 2664 (DS, DUKE, MICH, TEX, UC); 19 mi E of Raymondville, 12 July 1957, Correll \& Johnston 17878 (LL).

COLORADO: BOULDER CO: Base Line Lake, 25 Oct 1958, Weber 11149 (C).
ARIZONA: COCONINO CO: Flagstaff, 2 Aug 1884, Jones s.n. (DS).
WASHINGTON: KLICKITAT CO: sandy banks of Columbia River, Oct 1885, Suksdorf 83 (WTU). WHITMAN CO: Almota, 26 Aug 1894, Piper s.n. (NY).

OREGON: JACKSON CO: 10 mi SE of Sam's Valley, 16 July 1936, Peck 19341 (CAS). KLAMATH CO: Swan Lake Valley, 1895, Applegate 765 (DS). MARION CO: 1 mi N of Salem, 24 Aug 1921, Nelson 4160 (UC). MULTNOMAH CO: no locality, July 1877, Howell 393 (GH).

CALIFORNIA: COLUSA CO: Butte Sink Pond 2.7 mi N of Colusa, 6 Aug 1946, Mason \& Grant 12969 (CAS, DS, UC, WTU); Davis Tule, near Sycamore Slough, 11 July 1916, Stinchfield 465 (DS, UC). FRESNO CO: 4 mi N of Sanger, 4 June 1936, Hoover 1259 (UC). SISKIYOU CO: Oak Knoll Ranger Station, Siskiyou Mts, 11 Oct 1934, Wheeler 3317 (CAS, DS, JEPS, LL, NO, TEX, UC, WTU). STANISLAUS CO: Modesto Reservoir, 27 July 1935, Hoover 699 (UC). TULARE CO: Woodlake, 4 June 1936, Hoover 1284 (UC); 8 mi N of Visalia, 26 July 1941, Bacigalupi et al. 2507 (DS, GH, LL, UC, WTU). VENTURA CO: Mirror Lake, Ojai Valley, 12 Aug 1952, Pollard s.n. (CAS, UC).

MEXICO: COAHUILA: Tinaja Mesa Grande, high mesas 40 km NW of Hacienda de la Encantada, 14 Sep 1941, Stewart 1638 (TEX); Santa Rosa Mts, 27 July 1938, Marsh 1494 (F, TEX).

Cyperus distinctus Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.] : 24.1854. Type: United States, no specimen found, but description adequate for typification. Figure 11 (I-K).

Cyperus virens Michaux var. brittonii C. B. Clarke in Urban, Symb. Antill. 2: 26. 1900. Type: Florida, low grounds, Indian River, August, A. H. Curtiss 3062 (K!, lectotype; CAS!, F!, GH!, M!, MICH!, MO!, NY!, isolectotypes).

Tufted perennial up to 90 cm tall; stems erect, rigid, round, smooth, stramineous, light green or brown, $2-4.5 \mathrm{~mm}$ wide distally, $3.5-6 \mathrm{~mm}$ wide at the base; leaves $4-13$, about as long as the stem, $35-70 \mathrm{~cm}$ long; leaf sheath $5-15 \mathrm{~cm}$ long, brown or reddish brown, sometimes with sparse and inconspicuous transverse septa between the veins, weakly nodulose, occasionally persistent and becoming fibrous the second year; leaf blade $4-9(-12) \mathrm{mm}$ wide at mid-length, usually flat, stramineous to green, acute to attenuate at apex; involucral bracts $5-10$, foliaceous and spreading, up to 50 cm long, $2-7 \mathrm{~mm}$ wide, sheathless or with a sheath less than 3 mm long, usually flat, stramineous to light green, with sparse to common inconspicuous transverse septa between the veins, nodulose, apically acute; compound inflorescence $3-13 \mathrm{~cm}$ long; primary peduncles $5-9(-14), 3.5-10 \mathrm{~cm}$ long, $1-1.6 \mathrm{~mm}$ wide, round, smooth, rigid; secondary peduncles absent or $1-6$, up to 2 cm long, $0.5-1 \mathrm{~mm}$ wide, straight; heads hemispherical, the primary ones $10-20 \mathrm{~mm}$ wide and with $35-60$ spikelets, the secondary ones $8-12 \mathrm{~mm}$ wide and with $25-35$ spikelets; bracteoles ovate, 3 mm long, $5-7$-veined, chartaceous, apically mucronate; prophyll of spikelet $1-1.5 \mathrm{~mm}$ long, membranous to crustaceous, 3 -veined; spikelets ovate, (3.5-) $5-12$ ( -14 ) mm long, 2.5-3.5 $(-4) \mathrm{mm}$ wide, apically obtuse to acute, with $10-32$ scales; rachilla $0.25-0.4 \mathrm{~mm}$ wide, ca 0.2 mm thick, straight, stramineous with reddish brown longitudinal striations, the transverse scale scars $0.5-0.6 \mathrm{~mm}$ apart on each side; scale angles $\left(35^{\circ}-\right) 45^{\circ}$; scales $2-2.2(-3) \mathrm{mm}$ long, $0.8-1.4 \mathrm{~mm}$ wide, or $0.6-0.7 \mathrm{~mm}$
wide and triangular in lateral view, adaxially with sparse yellow or red glands, apically acuminate to mucronate and straight, distinctly bicarinate basally, the proximal abaxial groove between the two keels $1.3-1.8 \mathrm{~mm}$ long; medial part of scale subcartilaginous, green to golden brown, usually smooth distally; sides of scale mostly chartaceous, tough and reticulate with large cells when young but becoming smooth and glossy when mature, golden brown to brown, the margins slightly revolute on the upper one-half or for the full length of the scale, basally attached to the rachilla for ca 0.4 mm ; stamen solitary, $2-2.8 \mathrm{~mm}$ long, the filament $1.2-2 \mathrm{~mm}$ long, the anther ca 1 mm long; pollen $25-30 \mu$ in diameter; style ca 1 mm long, the stigmatic branches 0.5 mm long; achene filling ca three-fourths of the scale, bilaterally symmetric, dark brown, narrowly trigonous, obtusely to acutely angled, four times longer than wide, $1.5-2 \mathrm{~mm}$ long (total length), the white to light or dark brown spongy and torulose base 0.2 mm long and as wide as the achene, the body $1.1-1.4 \mathrm{~mm}$ long, the slender apical beak 0.2 mm long; achenial surfaces of unequal width, $0.2-0.3 \mathrm{~mm}$ wide adaxially, $0.3-0.4 \mathrm{~mm}$ wide abaxially, narrowly elliptic, planar.

Distribution. Known collections are from South Carolina, Georgia, Florida, and Louisiana, and from the Bahamas. Long and Lakela (1971) indicate that C. distinctus occurs in Brazil, but I did not find any collections from South America. Occurring on moist soil, frequently sandy peat, in marshes, fields, ditches, cypress swamps, or lowland pine woods, mostly near sea level (Fig. 6).

Discussion. The principal diagnostic feature for C. distinctus is the swollen base of the achene. The achene is bilaterally symmetric with the adaxial surface slightly narrower than the abaxial ones. The solitary stamen arises abaxially below the enlarged base of the achene, but the filament sometimes curves around the edge of the fruit and is pressed between the adaxial surface of the achene and the rachilla. The glossy and crustaceous scale subtending the achene has the longest proximal abaxial groove, $1.3-1.8 \mathrm{~mm}$ long, of all the taxa in the Luzulae group. The scales eventually abscise but not as readily as in most other taxa in the group. When the scale falls from the rachilla, it leaves a minute amount of hyaline tissue on the sides of the rachilla but not enough to create a truly "winged" condition.

The amount of morphological variation in C. distinctus is less than in other taxa in the Luzulae group. This may be linked to its limited occurrence and possibly corresponds with less opportunity to express genetic variation or to adapt to various environmental habitats. The presence of an enlarged spongy and torulose base of the achene that persists at maturity is a unique and probably specialized feature for $C$. distinctus and for the Luzulae group. Its presence increases the size, volume, and weight of the achene and predictably reduces dispersibility. The evolutionary significance of this structure appears to be in the restriction of the geographic range of $C$. distinctus.

A collection from Collier County, Florida (Lakela 31165) is presumed to be a hybrid between C. distinctus and C. pseudovegetus var. pseudovegetus. The achenes are abortive, but similar in outline to those of $C$. distinctus, and the scales are similar in texture and size to those of $C$. distinctus, but are arched forward like those in $C$. pseudovegetus var. pseudovegetus. The spikelets are aggregated into small hemispherical heads as in C. pseudovegetus.

Cyperus distinctus has frequently been misidentified as C. virens. Both are tall, robust perennials and have similar spikelets and scales, but differ in features of their achenes. Also, the stems of $C$. distinctus are round and smooth while those of $C$. virens are sharply angled and generally scabrous on the angles. The extensive distribution of C. virens overlaps with the geographically restricted C. distinctus only in the southeastern United States.

In the original description of $C$. virens var. brittonii, Clarke cited only one specimen, l'Herminier n. 44, which I have not found. The Curtiss specimen, here designated as the lectotype, was found in the type collection at Kew and was annotated by Clarke in 1892, eight years prior to the date of publication of the name.

Representative specimens:
UNITED STATES OF AMERICA: SOUTH CAROLINA: CHARLESTON CO: Sullivan's Island Rd, Charleston, Oct 1837, Gibbes s.n. (NY).

GEORGIA: MCINTOSH CO: W side of Sapelo Island, 20 Sep 1956, Duncan 20578 (F, GH).
FLORIDA: BREVARD CO: Okeechobee region, 27 Oct 1903, Fredholm 6184 (GH, NY). BROWARD CO: W of Pompano, 19 Jan 1930, Moldenke 457 (DUKE, MO); 10 mi SE of Andytown, 22 Aug 1964, Stimson 862 (DUKE, NO). CHARLOTTE CO: 3 mi E of Bermont, 8 Nov 1964, Hodgson 219 (GH). COLLIER CO: Naples, June 1940, Meebold 28067 (M). DADE CO: no locality, Nov-Dec 1903, Eaton 302 (F, GH, LL); Miami, July 1877, Garber s.n. (GH). DIXIE CO: near Old Town, 13 July 1965, Godfrey 65873 (LL, TEX). DUVAL CO: nr Jacksonville, 24 July-8 Oct 1894, Curtiss 5238 (F, GH, K, MO); South Jacksonville, 27 Aug 1939, Dyal s.n. (TEX). FRANKLIN CO: Lanark, 6 Oct 1955, Godfrey 54132 (GH, NY); Lanark Station, 8 Aug 1964, Henderson 64-406 (CAS). GLADES CO: near Lakeport, no date, Lovett 179 (DUKE). HAMILTON-MADISON CO: above Ellaville, 1 Oct 1955, Godfrey et al. 53938 (GH, NY). HENDRY CO: about 4 mi W of La Belle, 15 Aug 1963, Henderson 63-1607 (TEX). HIGHLANDS CO: Archbold Biological Station, 10 mi S of Lake Placid, 9 May 1945, Brass 15188 (GH). LEE CO: vicinity of Fort Meyers, 4 May 1916, Standley 159 (F, GH, MO, NY); Myers, marshes, July-Aug 1900, Hitchcock 385 (GH, MO, NY); S of Fort Myers, 19 Feb 1930, Moldenke 651 (DUKE, MO). MANATEE CO: no locality, no date, Simpson s.n. (MO). OSCEOLA CO: Lake Wilson Road, Kissimmee, 27 Sep 1937, Singeltary s.n. (DUKE). PALM BEACH CO: Palm Beach, 26 Dec 1895-11 Jan 1896, Hitchcock 2105 (G). PASCO CO: Aripeka, 14 July 1958, Kral 7301 (GH). PINELLAS CO: St. Petersburg, Sep 1935, Rhoades s.n. (GH). POLK CO: vicinity of Kissenger Spring, 15 mi S of Winter Haven, 15 Oct 1930, McFarlin 3040 (MICH); vicinity of Crooked Lake, $30-31$ Oct, McFarlin 3551 (MICH); about 4 mi SW of Bartow, 13 July 1956, Redfearn, Jr. 2694 (GH). SUWANNEE CO: no locality, June-July 1898, Hitchcock 2103 (F). TAYLOR CO: about 5 mi S of the Jefferson County line, 12 Aug 1963, Henderson 63-1496 (TEX). WAKULLA CO: St. Marks, 9 Aug 1965, Godfrey 65902 (LL).

LOUISIANA: ORLEANS PARISH: Audubon Park, New Orleans, 11 Dec 1931, Penfound s.n. (NO).

BAHAMAS: NEW PROVIDENCE: Water hole, Southwest Bay, 2 Sep 1904, Britton \& Brace 485 (US).

Cyperus eragrostis Lamarck, Tabl. Encycl. Meth. 1: 146. 1791. Type: not seen (presumably at P ; description applies to this taxon and the name is considered as the correct one). Figure 5 (I-L).

Cyperus monandrus Roth, Catalecta bot. 1: 3. 1797. Type: no locality or collector specified (B!, holotype).

Cyperus vegetus Willdenow, Sp. Pl. 1: 283. 1797. Type: no locality specified, Bouche s.n. (B, holotype in Willdenow Herbarium; photo of holotype, Mus. Bot. Berol. Film Nr. 1664/1, B!).

Cyperus vegetus Willdenow var. compactus Desvaux in Gay, Hist. Fís. Pol. Chile 6: 167. 1854?. Type: Chile, Santiago, Gay s.n. (B!, presumably an isotype).

Cyperus vegetus Willdenow var. triangularis Böckeler, Flora 42: 436. 1859. Type: no locality or collector specified (C!, neotype, annotated by Böckeler).

Cyperus serrulatus S. Watson, Proc. Amer. Acad. 17: 382. 1882. Type: California, Placer County, Auburn, Sep 1880, Vasey s.n. (NY!, isotype).

Cyperus vegetus Willdenow var. trigonus O. Kuntze, Rev. Gen. 3, pt. 2: 334. 1898. Type: Argentina, Córdoba, 16 Dec 1878, Hieronymus s.n. (NY!, lectotype); Argentina, Córdoba, in las Quintas, Galander 20 (NY!, paratype).

Cyperus eragrostis Lamarck var. compactus (Desvaux) Kukenthal, Pflanzenreich IV. 20 (Heft 101): 179. 1936.

Cyperus eragrostis Lamarck forma latifrons Kukenthal, Pflanzenreich IV. 20 (Heft 101): 179. 1936. Type: Chile, Valdivia, in Sumpfen, 15 Dec 1898, Buchtien s.n. (B!, lectotype; L!, isolectotype).

Cyperus eragrostis Lamarck forma tener Kukenthal, Pflanzenreich IV. 20 (Heft 101): 179. 1936. Type: Argentina, Concepción del Uruguay, May 1875, Lorentz 142 (B!, holotype).

Tufted perennial up to 90 cm tall; stems rigidly erect, triquetrous to round, smooth, grayish green, light green, or stramineous, $1.5-3 \mathrm{~mm}$ wide distally, $3-5 \mathrm{~mm}$ wide at the base; leaves $6-10$, up to three-fourths as long as the stem, ( $10-$ ) $25-50 \mathrm{~cm}$ long; leaf sheath $2-16 \mathrm{~cm}$ long, stramineous with red veins or often all dark reddish brown, with weak transverse septa between the veins, nodulose, occasionally persistent and becoming brownish black and fibrous the second year; leaf blade 5-8 $(-12) \mathrm{mm}$ wide at mid-length, flat or occasionally conduplicate, light green, grayish green, or stramineous, attenuate at apex; involucral bracts 4-8, foliaceous and spreading, $3-30(-50) \mathrm{cm}$ long, $1.5-8(-12) \mathrm{mm}$ wide, sheathless, flat or sometimes conduplicate, light green, grayish green or stramineous, with faint to prominent transverse septa between the veins, nodulose, apically attenuate; compound inflorescence $3.5-7 \mathrm{~cm}$ long; primary peduncles $3-10$ or sometimes absent, $2.5-5$ $(-12) \mathrm{cm}$ long, $1-1.2 \mathrm{~mm}$ wide, triquetrous, smooth, usually rigid; secondary peduncles absent or $1-3$ (seldom present), up to 1.5 cm long, ca 0.8 mm wide, straight; heads globose, the primary ones (12-) $20-40 \mathrm{~mm}$ wide and with $40-70$ spikelets, the secondary ones $12-20 \mathrm{~mm}$ wide and with $20-30$ spikelets; bracteoles ovate, $4-5 \mathrm{~mm}$ long, 7-11-veined, coriaceous or membranous, apically cuspidate to caudate; prophyll of spikelet ca 1.5 mm long, coriaceous or membranous, 5-11-veined; spikelets oblong, $5-20 \mathrm{~mm}$ long, $2.2-3 \mathrm{~mm}$ wide, apically acute, with (12-) 20-30 (-50) scales; rachilla $0.3-0.4 \mathrm{~mm}$ wide, ca 0.2 mm thick, sometimes inconspicuously winged, straight, stamineous to dark reddish brown, the transverse scale scars 0.8 mm apart on each side; scale angles $30^{\circ}-45^{\circ}$; scales $2-2.3 \mathrm{~mm}$ long, $1-1.4 \mathrm{~mm}$ wide, or $0.3-0.6 \mathrm{~mm}$ wide and triangular in lateral view, adaxially with several yellow or red glands mostly between the veins, apically acute and straight (excurved only in certain South American specimens), distinctly bicarinate basally, the proximal abaxial groove between the two keels $0.3-0.6(-0.8) \mathrm{mm}$ long; medial part of scale subcartilaginous, light brown or stramineous, occasionally scabrellate distally; sides of scale membranous, roughened and reticulate with large cells when young, becoming glossy and smooth when mature, golden brown, the margins hyaline and often revolute on the upper two-thirds to three-fourths of the scale, basally attached to the rachilla for 0.2 mm ; stamen solitary, $2-2.5 \mathrm{~mm}$ long, the filament $1-1.3(-1.8) \mathrm{mm}$ long, the anther $1-1.2 \mathrm{~mm}$ long; pollen $28-30 \mu$ in diameter; style $1-1.2 \mathrm{~mm}$ long, the stigmatic branches ca 0.5 mm long; achene filling two-fifths to one-half of the scale, radially symmetric (rarely bilaterally symmetric), black or dark brown, broadly trigonous, acutely angled, about two times longer than wide, $1.2-1.4 \mathrm{~mm}$ long (total length), the stipitate base 0.1 mm long or less and occasionally broadened, the body ca 1 mm long, and the slender apical beak $0.2-0.3 \mathrm{~mm}$ long; achenial surfaces usually equal in width, $0.5-0.6 \mathrm{~mm}$ wide, or rarely the adaxial surface 0.1 mm wider than the two abaxial ones, obovate, slightly concave.

Distribution. Except for a few probable introductions along the Atlantic coast in New Jersey, North Carolina, and Alabama, Cyperus eragrostis occurs naturally in North America only in Washington, Oregon, and California. It is more widespread in South America, occurring from Peru, Bolivia, and Surinam south to Brazil, Uruguay, Argentina, and Chile and also on the Juan Fernandez Islands and Easter Island. It is reported from Australia, the Canary Islands, and southern Europe. Habitats include marshes, moist sandy banks of streams or rivers, bogs, vernal pools, ditches, weedy roadsides, rocky crevices along streams, brushy serpentine slopes, and moist grasslands, from sea level to 800 meters in elevation (Fig. 7).

Discussion. Characterized by straight, acute apices, the scales of C. eragrostis are among the longest of any in the Luzulae group but they have one of the shortest proximal abaxial grooves, $0.3-0.6(-0.8) \mathrm{mm}$ long. The scales are about 0.8 mm apart on each side of the rachilla in contrast to $0.3-0.7 \mathrm{~mm}$ for related taxa. The achenes


Figure 7. Distribution of Cyperus eragrostis.
are broadly trigonous and usually radially symmetric and have surfaces that are equal in width and slightly concave.

Morphologically, C. eragrostis is less variable than other widespread taxa but more so than the geographically restricted $C$. distinctus. The most notable variation within $C$. eragrostis involves the lengths of the stems and the primary peduncles. Usually much taller, some mature plants are only about 10 cm tall and have been
described as C. eragrostis var. compactus (here synonymized); these diminutive forms can be found throughout the distribution of the species. Primary peduncles are usually rigid and evident, but in a few specimens they are absent and the compound inflorescence consists of a single, large, terminal head.

Cyperus eragrostis is geographically isolated from C. distinctus and C. virens, the two taxa to which it shows the greatest resemblance in habit. It can be distinguished from C. distinctus by its broadly trigonous achene lacking an enlarged base, and from C. virens, by its smooth, rather than scabrous or scabrellate, stem. The achenes of $C$. eragrostis resemble those of C. acuminatus, C. ochraceus, and C. reflexus var reflexus in that all are two to two and one-half times longer than wide and usually fill two-fifths to three-fifths of the scale. These taxa can be readily distinguished from $C$. eragrostis as follows: C. acuminatus is an annual, and has shorter spikelets and scales with excurved apices; C. ochraceus has convex or planar achenial surfaces and scales that are declined $60^{\circ}$ to $90^{\circ}$ from the rachilla; and C. reflexus var. reflexus has fewer and narrower leaves, shorter stems, red glossy scales, and usually an elongate and erect lowermost involucral bract.

Nomenclaturally, the main confusion concerning this taxon has been the frequent use of the name C. vegetus Willdenow in place of C. eragrostis Lamarck. Although I was unable to locate the type specimen, the original description of $C$. eragrostis Lamarck applies to this taxon.

## Representative specimens:

UNITED STATES OF AMERICA: OREGON: CURRY CO: Siskiyou National Forest, 20.4 mi W of Glendale, 10 July 1973, Denton 3169 (MICH, WTU); near Agness, 7 July 1929, Henderson 11568 (UC); bog near Gold Beach, 24 July 1945, Peck 23965 (WTU). JOSEPHINE CO: near Rouge River Rapids, 23 June 1931, Peck 16354 (DS, UC). LANE CO: just N of Eugene, 6 Aug 1964, Dennis 2636 (DS, GH, NY, WTU).

CALIFORNIA: ALAMEDA CO: Niles Canyon, near Sunol, 14 Aug 1933, Purer 5440 (BM); near Decoto, 1 Oct 1933, Ewan 8150 (UC). AMADOR CO: vicinity of Ione, June 1904, Braunton 1012 (BM, DS, NY, UC); 3.6 mi W of Pine Grove, 1 July 1933, Wolf 5154 (TEX, UC, WTU). BUTTE CO: near Oroville, 2 Oct 1896, Brown 119 (L); Chico, 27 July 1903, Copeland 3490 (F, GH, LL, LY, MICH, NY, UC). CALAVERAS CO: 1 mi NW of San Andreas, 18 July 1936, Belshaw \& Gifford 2503 (UC). COLUSA CO: 1.6 mi W of Williams, 5 Sep 1946, Mason \& Grant 13117 (UC). CONTRA COSTA CO: San Leandro Lake near mouth of Redwood Creek, 3 Dec 1940, Morley 90 (DS, DUKE, GH, MICH, MO, NO, UC, WTU). DEL NORTE CO: Crescent City, no date, Nobs \& Smith 1313 (DS, UC). EL DORADO CO: 2 mi S of Pleasant Valley on road to Somerset, 3 May 1959, Shannon 42 (WTU). FRESNO CO: Fish Creek, San Joaquin River, 21 May 1928, Jepson 12877 (JEPS). GLENN CO: Orland, 26 Sep 1929, Jepson 15276 (JEPS). HUMBOLDT CO: vicinity of Orick, 2 July 1962, Barclay et al. 1279 (LL); Trinity River Valley, 17 July 1935, Tracy 14099 (DS, TEX, UC). LAKE CO: Mt. St. Helena, 4 May 1940, Carrillo \& Sableman 9688 (UC). LOS ANGELES CO: San Gabriel Mts., Pine Canyon Dam, 20 Aug 1933, Wheeler 2088 (JEPS). MADERA CO: 5 mi W of Coarsegold, Sierra Nevada, 2 May 1931, Benson 2783 (DS, UC). MARIN CO: Phoenix Lake, Mt. Tamalpais, 24 Sep 1921, Jepson 9500 (JEPS). MARIPOSA CO: 1 mi W of Indian Flat, 23 Sep 1960, Rose 60101 (B). MENDOCINO CO: SE of Ukiah, 19 July 1943, Jepson 20868 (JEPS). MERCED CO: nr Merced, 26 Oct 1894, Congdon s.n. (DS). MODOC CO: 1 mi N of Corning, 22 July 1947, Grant \& Schneider 8164 (B, UC). MONTEREY CO: just S of Carmel, 1 Apr 1970, Howell 46514 (B); Prewitt Creek, 13 Apr 1961, Hardham 7400 (CAS). NAPA CO: W side of Wooden Valley Grade, 1 Dec 1935, Carter 1018 (UC). NEVADA CO: 9 mi E of Grass Valley, 12 June 1972, Hansen \& Hansen 904 (LL). ORANGE CO: Costa Mesa, back of Newport Bay, 15 June 1932, Booth 1201 (JEPS, NO). PLACER CO: Auburn, 1845, Ames s.n. (LL), Aug 1894, Ames s.n. (GH); 2 mi S of Auburn, 15 Aug 1925, Cain 4 (DS). RIVERSIDE CO: near Corona, 9 June 1917, Crawford \& Johnston 1256 (DS, F, MICH). SACRAMENTO CO: 5 mi SE of Folsom, 8 Aug 1936, Yates 5949 (UC). SAN BERNARDINO CO: Lytle Creek below Mill St. Bridge, 9 Oct 1907, Parish 6495 (DS, F, LY, TEX). SAN DIEGO CO: San Diego, 24 July 1923, Fisher s.n. (L). SAN FRANCISCO CO: Sag Pond at entrance to San Francisco county prison, 28 Aug 1946, Grant \& Mason 13083 (DUKE, UC). SAN JOAQUIN CO: 3.2 mi E of Escalon, 23 June 1934, Wiggins 6937 (DS). SAN LUIS OBISPO CO: Graves Creek, Paradise Valley, 20 Aug 1950, Hardman 1305 (CAS). SAN MATEO CO: near Lake San Andreas, 9 Oct 1926, Howell 2216 (UC); Burlingame, 20 Sep 1965, Rose 65107 (B, DS, ENCB, TEX, WTU). SANTA BARBARA CO: Santa Barbara, 18 Sep

1956, Pollard s.n. (CAS). SANTA CLARA CO: W. Palo Alto, 15 Aug 1959, Thomas 8061 (DS); about 3 mi SE of Los Altos, 24 June 1954, Thomas 4307 (DS). SANTA CRUZ CO: Mill Creek Dam, SW of Eagle Rock, 2 July 1954, Hesse 1320 (CAS); about 5.5 mi E of Watsonville, 31 May 1953, Thomas 3297 (CAS, DS). SHASTA CO: Redding, 17 Sep 1941, Drouet \& Richards 4272 (F), 4268 (F, WTU). SOLANO CO: N of Rio Vista, 17 Aug 1945, Mason 12663 (DS, UC); Vacaville, 20 Oct 1942, Jepson 20741 (JEPS). SONOMA CO: 4 mi SE of Sonoma, 29 Sep 1937, Baker 6037 (C, UC). STANISLAUS CO: Modesto, 2 Oct 1938, Hoover 3875 (UC); 1 mi N of Oakdale, 7 May 1936, Jepson 17534 (JEPS). SUTTER CO: 5 mi W of Live Oak, 9 May 1936, Ewan \& Ewan 9534 (JEPS, NO, UC). TEHAMA CO: 2 mi SE of Beegum, 15 June 1943, Pitelka 202 (UC). TULARE CO: near Soda Springs on Indian Reservation, 13 June 1964, Smith 1265 (JEPS, WTU). TUOLOMNE CO: Spring Gulch near Bear Creek, 23 May 1919, Williamson 190 (DS, UC). VENTURA CO: Mirror Lake, Ojai Valley, 12 Aug 1952, Pollard s.n. (CAS, UC). YUBA CO: Swartsville, 29 July 1934, Jepson 16760 (JEPS).

SURINAM: NICKERIE: Wageningen, van Hortus Kopenhagen, 24 Sep 1953, Boom 531928 (L).

PERU: APURIMAC: Chincheros, 1 Nov 1935, West 3686 (GH, UC). CAJAMARCA: km 127 E of Olmos on Rio Huancabamba, 12 Jan 1964, Hutchinson \& Wright 3553 (UC).

BOLIVIA: COCHABAMBA: grounds of the Colegio Americana Primera at Cochabamba, 7 Mar 1939, Eyerdam 24662 (UC); vic. Cochabamba, 1891, Bang 1072 (M, MICH, NY).

BRAZIL: PARANA: Mun. União de Vitória, Estr. p/Pôrto Vitoria, 16 Oct 1966, Hatschbach 14091 (L); Mun. Piraquará, Rio Bracajuvava, 10 Oct 1966, Hatschbach 14831 (L). RIO DE JANEIRO: near Rio de Janeiro, 1838-42, Capt. Wilkes Expedition s.n. (GH). SANTA CATARINA: Matos Costa, 9 Dec 1962, Klein 3.606 (L); Serra de Boa Vista, São José, 10 Nov 1960, Reitz \& Klein 10.391 (L).

URUGUAY: CANELONES: Independencia, Nov 1926, Herter 81306 (B, M); Jolero, 15 Jan 1938, Osten 21857 (GH), 25 Feb 1928, Osten 19328 (F, GH). COLONIA: La Estanzuela, 14 Jan 1944, Bartlett 21295 (MICH). MALDONADO: Isla Lobos, 4 Jan 1941, Descole 55 (GH, UC). MONTEVIDEO: Atahualpa, Dec 1925, Herter 79875 (M); Miguelete, 1938, Herter 60833 (B). RIVERA: Cuñapirú, 1928, Wright s.n. (BM). SAN JOSE: Santa Lucía, 25 Nov 1929, Osten 21693 (GH).

ARGENTINA: BUENOS AIRES: San Isidro, 19 Dec 1942, Bartlett 19248 (MICH); Campana, 27 Nov 1938, Beetle 23069 (UC); Buenos Aires, 19 Mar 1945, Alvarez 671 (F), 19 Nov 1938, Beetle 23015 (UC), 26 Nov 1912, Rodriguez 89 (TEX); Tigre, 21 Dec 1942, Bartlett 19266 (MICH); Elizalde, 27 Dec 1929, Cabrera 1269 (GH). CATAMARCA: El Rodeo (S. Ambato), Feb 1941, Parodi 14227 (GH); Dept. Andalgala, Estancia Yunka Suma, Río Chacra, 2 Nov 1950, Sleumer 61 (B). CORDOBA: La Falda, 1932, Jordan s.n. (GH); Estancia Germania, June-Dec 1874, Lorentz 120 (BM, M); Córdoba, Nov 1878, Hieronymus s.n. (BM). CORRIENTES: Dept. Curuzư Cuatiá, Ruta 14, 13 Nov 1964, Pedersen 7127 (C). ENTRE RIOS: Dept. Federación, Buena Esperanza, 13 Dec 1957, Pedersen 4707 (C). MENDOZA: St. Rosa, 1904-05, Virven-Haarings s.n. (C). RIO NEGRO: vicinity of General Roca, Sep 1914-Feb 1915, Fischer 200 (BM, F). SALTA: Dept. Rivadavia, Marguesado, 27 Nov 1945, Cuezzo 1493 (MO). SAN JUAN: Desamparador, Localidad chimba's, 16 Nov 1945, Cuezzo 1133 (MO). TUCUMAN: San Pedro de Colalao de Colalao, 9 Mar 1917, Castillón 154 (GH); Dept. Burruyaco, Cerro el Nogalika, Apr 1929, Venturi 8825 (GH); Dept. Chicligasta, Estancia Las Pavas, Sep 1925, Venturi 4049 (UC).

CHILE: ACONCAGUA: Valle de Marga-Marga SE from Valparaiso, no date, Jaffuel \& Pirion 3301 (GH). ARAUCO: Arauco, 6 Mar 1925, Pennell 12939 (GH). CAUTIN: Tenuco, Jan 1933, Montero 1178 (GH). CONCEPCION: 2 mi NE of Florida, 18 Feb 1958, Eyerdam 10696 (F, NY, UC). COQUIMBO: Rivadavia, Dec 1923, Werdermann 174 (BM, F, GH, M, NY, UC), 167 (BM). MALLECO: Angol, "El Vergel," 21 Nov 1933, Marillan 182 (UC); El Vergel, 10 km S of Angol, 30 Dec 1935, West 4935 (UC). SANTIAGO: vicinity of Santiago, mts near Río Colorado, 15 Feb 1902, Hastings 549 (UC). VALDIVIA: in Sümpfen, 15 Dec 1898, Buchtien s.n. (L). VALPARAISO: 20 km N of Valparaíso, 16 Feb 1939, Beetle 26103 (UC); El Tranque, Vina del Mar, ca 12 km from Valparaiso, 10 Dec 1938, Morrison 16834 (MO, UC); forest near Quintero, 10 Jan 1952, Poulsen s.n. (C). JUAN FERNANDEZ ISLANDS: Masafuera, rocks between Curois and Vacas, 13 Feb 1917, Skottsberg \& Skottsberg 426 (BISH, BM); Masafuera, Quebrada Vacas, 28 Nov 1965, Solbrig et al. 3673 (GH, MICH); Masatierra, from Cumberland Bay to Quebrada Puerto Francés, 16-17 Dec 1964, Solbrig et al. 3871 (GH, NY, UC), near Cumberland Bay, 4 May 1939, Morrison 17402 (UC). EASTER ISLAND: Rano Kao, edge of marshy crater floor, 15 Jan 1935, Chapin 1015 (BISH).

Cyperus intricatus Schrader ex J. A. Schultes in Roemer \& Schultes, Syst. Veg. Mantiss. 2: 98. 1824. Type: Brasil, Prinz von Wied-Neuwied ["In Brasilia, Princ. Ser. Max. Neowid.'] (LE?, holotype, not seen). Figure 8.

Cyperus consanguineus Kunth, Enum. Pl. 2: 42. 1837. Type: Brasilia meridionalis, Sello 4800 (B!, holotype).

Cyperus chamissoi Schrader ex Nees in Martius, Flora Brasil. 2, pt. 1: 33. 1842. Type: in insula S. Catharinae Brasiliae (not seen, but description fits C. intricatus; collections by Chamisso s.n. and Eschscholz s.n. are cited in protologue; one of these could serve as a lectotype if located). Cyperus widgrenii Böckeler, Bot. Jahrb. Syst. 5: 499. 1884. Type: Brasil, Prov. Minas Gerais, 1845, Widgren s.n. (B!, holotype).

Cyperus schenckianus Böckeler, Beitr. Cyper. 2: 4. 1890. Type: Brasil, Prov. Sta. Catharina, Blumenau, 18 Oct 1886, Schenck s.n. (B!, holotype).

Cyperus ciliolatus Böckeler, Beitr. Cyper. 2: 5. 1890. Type: Brasil, Prov. Sta. Catharina, Campo Allegre, Foinville, São Bento, 24 Nov 1886, Schenck 1312 (B!, holotype).

Cyperus longicaulis Böckeler, Allg. Bot. Z. Syst. 1: 202. 1895. Type: Brasil, Prov. Santa Catharina, im sumpfe auf dem Campo der Serra do Oratorio, Jan 1880, Ule 1602 (B!, holotype).

Cyperus varius Böckeler, Allg. Bot. Z. Syst. 1: 202. 1895. Type: Argentina, Laguna, Cordillera de Misiones, Niederlein 2154 (B!, holotype).

Cyperus usteri Palla, Oesterr. Bot. Z. 66: 257. 1907. Type: Brasil, São Paulo, Ipiranga, 7 Dec 1906, Usteri 8 or Horto Oswaldo Cruz n. 9363 (B!, isotype).

Cyperus consanguineus Kunth var. chamissoi (Schrader ex Nees) Kukenthal, Pflanzenreich IV. 20 (Heft 101): 171. 1936.

Cyperus consanguineus Kunth var. varius (Böckeler) Kukenthal, Pflanzenreich IV. 20 (Heft 101): 171. 1936.

Cyperus consanguineus Kunth var. usteri (Palla) Kukenthal, Pflanzenreich IV. 20 (Heft 101): 171. 1936.

Cyperus reflexus Vahl var. intricatus (Schrader ex J. A. Schultes) Kukenthal, Pflanzenreich IV. 20 (Heft 101): 174. 1936.

Cyperus virens Michaux var. widgrenii (Böckeler) C. B. Clarke ex M. Barros, Anales Mus. Argent. Ci. Nat. "Bernardino Rivadavia" 39: 294. 1938.

Tufted perennial up to $50(-88) \mathrm{cm}$ tall; stems erect, triquetrous, sometimes flexuous, smooth or scabrellate on the angles, grayish green, green, or stramineous, 2.2 mm wide distally, 4 mm wide at the base; leaves ca 4 , usually ca one-half as long as the stem, but sometimes fully as long as the stem, up to 48 cm long; leaf sheath up to 19 cm long, dark red to reddish purple, usually with conspicuous transverse septa between the veins, faintly to prominently nodulose, sometimes persistent and becoming dull brown and somewhat fibrous the second year; leaf blade $5(-11) \mathrm{mm}$ wide at mid-length, conduplicate or flat, grayish green, green, or stramineous, attenuate at apex; involucral bracts $4-8$, usually foliaceous and spreading but the lowermost and longest bract sometimes $\pm$ erect, up to 28 cm long, up to 9 (rarely -16 ) mm wide, generally sheathless, conduplicate or flat, grayish green, green, or stramineous, occasionally with transverse septa between the veins, nodulose, apically attenuate; compound inflorescence $5-6 \mathrm{~cm}$ long; primary peduncles $6-13$, up to 8 cm long, up to 1.2 mm wide, round or flattened, sulcate, prominently scabrellate, stiff to flexuous; secondary peduncles $1-4(-7)$, up to 3 cm long, up to 0.7 mm wide, flexuous; heads hemispherical, the primary ones up to 13 mm wide and with ca 60 spikelets, the secondary ones up to 8 mm wide and with ca 30 spikelets; bracteoles ovate, $3-7 \mathrm{~mm}$ long, $5-11$-veined, membranous to coriaceous, apically attenuate to caudate; prophyll of spikelet up to 3 mm long, membranous, $3-5$-veined; spikelets broadly ovate, $4-6 \mathrm{~mm}$ long, $3.5-4 \mathrm{~mm}$ wide, apically obtuse to acute, with $8-14$ scales; rachilla ca 0.3 mm wide, ca 0.1 mm thick, mostly straight, dark reddish black or dark red, the transverse scale scars ca 0.5 mm apart on each side; scale angles $30^{\circ}-45^{\circ}$; scales $2-3 \mathrm{~mm}$ long, $1.2-1.6 \mathrm{~mm}$ wide, or $0.5-0.8 \mathrm{~mm}$ wide and either triangular or lunate in lateral view, adaxially with a few red glands, apically mucronate and straight or sometimes subtly excurved, weakly bicarinate basally, the proximal abaxial groove between the two keels $0.6-0.8 \mathrm{~mm}$ long; medial part of scale firmly membranous to cartilaginous, pale green, light reddish brown to stramineous, prominently scabrellate distally (rarely smooth); sides of scale chartaceous and reticulate with large cells, or sometimes smooth and glossy when mature, red, reddish black, reddish brown, or light brown, the margins mostly papyraceous, hyaline only on the outermost 0.1 mm ,
sometimes revolute on the lower three-fifths of the scale, basally attached to the rachilla for 0.2 mm ; stamens one or two, $3.5-4.5 \mathrm{~mm}$ long, the filaments $2.5-3 \mathrm{~mm}$ long, the anthers $1.1-1.8 \mathrm{~mm}$ long, the connective extended less than 0.1 mm apically; pollen $25-30 \mu$ in diameter; style $0.8-1.2 \mathrm{~mm}$ long, the stigmatic branches $0.6-1.0 \mathrm{~mm}$ long; achene filling two-fifths to three-fourths of the scale, radially symmetric (rarely asymmetric), light to dark brown or brownish black, narrowly to broadly trigonous, acutely to obtusely angled, two and one-half to five times longer than wide, $1.2-1.5 \mathrm{~mm}$ long (total length), the stipitate base $0.1-0.2 \mathrm{~mm}$ long and ca 0.15 mm wide, the body $0.8-1.3 \mathrm{~mm}$ long, and the slender apical beak up to 0.2 mm long; achenial surfaces $\pm$ equal in width, $0.4-0.5(-0.6) \mathrm{mm}$ wide, mostly obovate (infrequently elliptic), planar to slightly concave.


Figure 8. A-E. Cyperus intricatus (based on Reitz \& Klein 10.581); A, inflorescence, $\times 1 / 2$; B, spikelet, $\times 5$; C, scale, $\times 15$; D, achene, $\times 15$; E, surface of peduncle, $\times 20$.

Distribution. One of the most restricted taxa in the Luzulae group, C. intricatus occurs in southern Brazil and northeastern Argentina. Found in moist places, usually near lakes or streams (elevations not available) (Fig. 10).

Discussion. Important features for differentiating $C$. intricatus are its scabrellate peduncles, broadly ovate spikelets, obovate achenial surfaces, usually two stamens per flower, and long, slender scales that do not readily disarticulate from the rachilla. The straight or inwardly arched scales typically have red or reddish brown sides and prominent crystalline hairs or teeth distally. The lowermost involucral bract is often stiff and erect and appears like a prolongation of the stem.

The presence or absence of peduncles in the inflorescence appears to lack significance for recognizing infraspecific ranks but is one of the most conspicuous aspects of variation in this species. As in several other taxa (C. eragrostis, C. luzulae, and $C$. reflexus), the compound inflorescence may consist either of a single large head terminating the stem or of a complex branching system with the heads on primary and secondary peduncles. The widths of the foliage leaves and involucral bracts are also variable. The type specimen of C. intricatus, unfortunately, is not typical for the species, as its involucral bracts are only about one millimeter wide and it is more diminutive than other specimens; however, its spikelets, scales, and achenes are characteristic.

The presence of usually two stamens per flower and of scales that disarticulate tardily, if at all, tend to make C. intricatus a borderline taxon in the Luzulae group. Only one other related species, C. virens, has one or two stamens per flower, and only C. distinctus has scales that do not abscise so readily. The retention of the scales on the rachilla might serve to reduce the dispersibility of their enclosed achenes; the restricted geographic distribution of $C$. intricatus may be explained by this structural feature of the spikelet. The similarity of the spikelet structure, and of vegetative features, of $C$. intricatus to others in the Luzulae group, warrant its inclusion here.

Representative specimens.
BRAZIL: MINAS GERAIS: no locality, 1845, Widgren s.n. (B, M). PARANA: Mun. Piraquara, Rio Bracajuvava, 10 Nov 1966, Hatschbach 14831 (NY); Mun. S. José dos Pinhais, 31 Nov 1961, Hatschbach 8292 (B). RIO GRANDE DO SUL: Farroupilha, 31 Oct 1957, Camargo 2234 (B), 15 Nov 1956, Camargo 924 (B); Taquari, 8 Dec 1957, Camargo 2723 (B); Mun. Santa Cruz, Pinhal, Feb 1925, Jürgens 95 (B); Mun. Venanrio, Ayres, Tanjerinas, Dec 1923, Jürgens 81 (B); S. Fr. de Paula, Vila Oliva, 16 Jan 1946, Rambo S. J. 33173 (MO). SANTA CATARINA: Serra da Boa Vista, São José, 26 Dec 1960, Reitz \& Klein 10.581 (UC); Campo de Areão, Santa Cecilia, 19 Dec 1962, Reitz \& Klein 14.167 (B); Blumenau, 18 Oct 1886, Schenck 740; São Bento, 24 Nov 1886, Schenck 1312 (B); Mun. Campo Alegre, 9 Nov 1956, Smith \& Klein 7464 (NY); bei Itajahy, Nov 1885, Ule 555 (B); no locality, Nov 1889, Ule 1372 (B), Jan 1890, Ule 1602 (B). SAO PAULO: Ypiranga, 7 Dec 1906, Usteri 9363 (B).

ARGENTINA: MISIONES: Laguna, Cordillera Misiones, 7 Dec 1886, Niederlein 2154 (B).
Cyperus luzulae (Linnaeus) Retzius, Obs. Bot. 4: 11. 1786. Basionym: Scirpus luzulae Linnaeus, Sp. Pl., ed. 2. 75. 1762. Type: No. 71.45 of the Linnaean Herbarium (LINN, holotype, IDC microfiche!). Figure 13 (L-O).

Cyperus conoideus L. C. Richard in Actes Soc. Hist. Nat. Paris 1: 106. 1792. Type: no locality specified, Richard s.n. (P, holotype; C!, isotype).

Cyperus sphaerostachys Link, Jahrb. Gewächsk. 1 (Heft 3): 89. 1820. Type: America meridionale, Humboldt s.n. (B, holotype in Willdenow's herbarium; photo, Mus. Bot. Berol. Film Nr. 2534, B!).

Cyperus trinitatis Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.]: 26. 1854. Type: in insl. Trinitatis, Sieber. fl. Tr. 1 (M!, isotype).

Cyperus luzulae (Linnaeus) Retzius var. minor Böckeler, Linnaea 35: 561. 1868. Type: Surinam, Hostmann s.n. (B!, holotype).

Cyperus entrerianus Böckeler, Flora 61: 139. 1878. Type: Argentina, Concepción del Uruguay, April 1876, Lorentz s.n. (B!, holotype).

Cyperus tucumanensis Böckeler, Bot. Jahrb. Syst. 7: 274. 1886. Type: Argentina, Tucumán, 29 Dec 1872, Lorentz \& Hieronymus 1086 (B!, holotype).

Cyperus pseudosurinamensis Böckeler, Allg. Bot. Z. Syst. 1: 201. 1895. Type: in insula Martinica, Hahn s.n. (B!, fragment of holotype).

Cyperus luzulae (Linnaeus) Retzius var. tucumanensis (Böckeler) C. B. Clarke, Bull. Herb. Boiss. II. 3: 1007. 1903.

Cyperus bangianus Gandoger, Bull. Soc. Bot. France 66: 297. 1920. Type: Bolivia, Yungas, 1890, Bang 531 (BISH!, C!, L!, M!, NY!, isotypes).

Cyperus guatemalensis Gandoger, Bull. Soc. Bot. France 66: 297. 1920. Type: Guatemala, Alta Verapaz, Türckheim 128 (NY!, isotype).

Cyperus luzulae (Linnaeus) Retzius forma pallidiflorens Kukenthal, Pflanzenreich IV. 20 (Heft 101): 171. 1936. Type: Dominican Republic, Prov. Santo Domingo, Llano Costero, Cuenca, in moist savannas, Ekman 10975 (F!, NY!, isotypes).

Cyperus entrerianus Böckeler var. parvicapitatulatus Kukenthal, Pflanzenreich IV. 20 (Heft 101): 170. 1936. Type Colombia, Macondo-Wald, an nassen stellen, 10 June 1927, A. Schultze 935 (B!, holotype).

Cyperus luzulae (Linnaeus) Retzius var. entrerianus (Böckeler) M. Barros, Anales Mus. Argent. Ci. Nat. "Bernardino Rivadavia" 39: 309. 1938.

Tufted perennial up to $50(-92) \mathrm{cm}$ tall; stems rigidly erect, round or roundly triquetrous, smooth, green, grayish green, or stramineous, $1-2 \mathrm{~mm}$ wide distally, $2-3.5 \mathrm{~mm}$ wide at the base; leaves (3-) 6-10, one-half as long to as long as the stem, $15-54(-70) \mathrm{cm}$ long; leaf sheath $2-14 \mathrm{~cm}$ long, sometimes with red glands adaxially, stramineous, brown, or dark reddish brown, with or without transverse septa between the veins, sometimes nodulose, often persistent and becoming dull brown the second year; leaf blade $5-12 \mathrm{~mm}$ wide at mid-length, usually flat, green, or grayish green, acute at apex; involucral bracts $7-12$, foliaceous and spreading, usually flat, $7-70 \mathrm{~cm}$ long, $1-7 \mathrm{~mm}$ wide, usually with a small sheath ca 0.1 mm long or sheathless, green or grayish green, with inconspicuous transverse septa between the veins, faintly nodulose, apically acute; compound inflorescence up to 7 cm long; primary peduncles $4-10$ or absent, $1-7 \mathrm{~cm}$ long; $1-1.3 \mathrm{~mm}$ wide, round or triquetrous, smooth, rigid; secondary peduncles usually absent or $1-2$, up to 1 cm long, ca 0.5 mm wide, straight; heads often appearing pyramidal or cylindrical, seldom spherical or hemispherical; primary heads $10-15 \mathrm{~mm}$ long and ca 10 mm wide, with $75-150$ spikelets; secondary heads barely pedunculate if at all, $10-13 \mathrm{~mm}$ long and $7-10 \mathrm{~mm}$ wide, with $50-100$ spikelets; bracteoles ovate, ca 3 mm long, 7 -veined, coriaceous, membranous, apically cuspidate to caudate; prophyll of spikelet ca 1 mm long, membranous, 7 (-or more)-veined; spikelets ovate, $1.5-4.5 \mathrm{~mm}$ long, $0.8-2.2 \mathrm{~mm}$ wide, apically rounded, with $6-18$ scales; rachilla $0.15-0.2 \mathrm{~mm}$ wide, ca 0.15 mm thick, rarely winged, usually arched (rarely straight), green when immature or stramineous, brown, or dark reddish brown, the transverse scale scars ca 0.5 mm apart on each side; scale angles $30^{\circ}-45^{\circ}$; scales $1-1.5 \mathrm{~mm}$ long ( -2 mm only in several South American specimens), $0.6-0.8$ $(-1) \mathrm{mm}$ wide, or ca 0.4 mm wide and either triangular or lunate in lateral view, adaxially with red, glandular, longitudinal striations, apically obtuse to rounded and incurved, distinctly bicarinate basally, the proximal abaxial groove between the keels $0.8-1.4 \mathrm{~mm}$ long; medial part of scale subcartilaginous, dull white, stramineous or light brown, seldom scabrellate distally; sides of scale membranous, opaque and reticulate with large cells but often becoming glossy when mature, usually stramineous, or occasionally golden brown or reddish brown, the margins hyaline and revolute on the upper two-thirds to three-fourths of the scale, basally attached to the rachilla for 0.2 mm ; stamen solitary, $1-1.5(-2) \mathrm{mm}$ long, the filament $0.5-1.5 \mathrm{~mm}$ long, the anther $0.5-0.7 \mathrm{~mm}$ long; pollen ca $25 \mu$ in diameter; style ca 0.5 mm long, the stigmatic branches ca 0.3 mm long; achene filling three-fourths to all of the scale, bilaterally symmetric, brown to black, narrowly trigonous, obtusely angled, falcate, four to five times longer than wide, $0.9-1(-1.2) \mathrm{mm}$ long (total length), the stipitate base up to 0.1 mm long, the body $0.7-1 \mathrm{~mm}$ long, and the slender apical beak
$0.1-0.2 \mathrm{~mm}$ long; achenial surfaces equal or slightly unequal in width, the adaxial surface either wider than, equal to, or narrower than the two abaxial ones, $0.2-0.3 \mathrm{~mm}$ wide, elliptic to slightly ovate or obovate, planar to scarcely convex.

Distribution. A wide-ranging species found in the Greater and Lesser Antilles, and in Florida and Texas, south through Mexico, Central America, and South America to Argentina, growing in sandy or silty soils in deciduous or mixed evergreen forests, pastures, ditches, meadows, or along streams or logging roads from sea level to 1500 meters in elevation (Fig. 9).

Discussion. The achenes of C. luzulae are characteristically small, bilaterally symmetric and four to five times longer than wide and fill three-fourths or more of the scales. The stipitate base of the achene is less well developed than in most other taxa but similar to that of C. pseudovegetus. Morphologically, C. luzulae most closely resembles $C$. pseudovegetus var. megalanthus.

The coloration of the scale is usually diagnostic with the medial part white or stramineous and the sides stramineous. In South America, however, the sides of the scale are occasionally reddish brown. The scales are short, only $1-1.5 \mathrm{~mm}$ long, except in certain South American specimens in which they may be up to 2 mm long. The surface of the scale is generally dull, but may be glossy at maturity. Although the scale apices are typically round or obtuse, they may vary from round to acute on a single head in some plants. The acute apex is not apt to be noted except in mature scales, as the apex is often incurved when the scales are immature.

Conspicuous variation in the plants can be noted in the lengths of the primary and secondary peduncles. The primary peduncles are usually evident and longer than one centimeter. The plants which bear sessile heads are mostly restricted to Panama, except for a collection from Colombia in which one plant bore sessile heads and another plant bore pedunculate ones. The typical pyramidal or cylindrical heads of the compound inflorescence are created when the few secondary peduncles are so short that they are obscured by the spikelets.

In a few collections from Oaxaca, Mexico, the number of spikelets in the individual heads is about one-third that of other collections. This tends to make these plants appear distinctive in comparison with those of other populations, but the features of the achenes, scales, stems, and leaves remain so similar that segregation of a new taxon does not seem warranted. Such reduction in the number of spikelets and corresponding number of achenes (seeds) undoubtedly affects the reproductive potential of the plants.

There are two modes of variation in C. luzulae reflected by the nature of the scales and heads of the compound inflorescence. One is the "entrerianus" mode characterized by hemispherical or spherical heads, and glossy scales with mostly acute apices. The "luzulae" mode is delineated by dull scales, pyramidal or cylindrical heads, and scales with obtuse apices. The "entrerianus" mode has been recognized at the specific and varietal levels, but its features merge so well with the "luzulae" form throughout the total geographic distribution that its separate recognition cannot be justified at this time.

A small, tufted plant from Argentina (Pedersen 8224) exhibits inflorescences that are intermediate between the "entrerianus" and "luzulae" modes of variation. It was collected on a clearing in a woodland where flooding often occurs. Such conditions undoubtedly affect the growth of these plants, as they are small in stature, and the inflorescences may be entirely or partially comprised of leafy branches. The proliferation of vegetative shoots in the compound inflorescence occurs only occasionally in this species.


Figure 9. Distribution of Cyperus luzulae.
Representative specimens:
UNITED STATES OF AMERICA: FLORIDA: SANTA ROSA CO: Pensacola, 6 Aug 1941, Brinker 413 (MO).

MISSOURI: ST. LOUIS CO: St. Louis, 1 Aug 1891, Eggert s.n. (MO).
OKLAHOMA: CRAIG CO: Vinita, Indian Territory, 15 July 1880, Letterman s.n. (MO). CREEK CO: Sapulpa, Indian Territory, 22 July 1894, Bush 615 (MICH).

TEXAS: CAMERON CO: 25 mi N of Brownsville, 16 June 1941, Runyon 2761 (TEX).
MEXICO: TAMAULIPAS: Sierra de Tamaulipas, ca 40 km NNW of Aldama, Mpio. de Aldama, 28 July 1957, Dressler 2048 (GH, MICH, MO). SAN LUIS POTOSI: Valles, 19 Aug 1937, Fisher 37239 (F, GH, UC); 1.5 mi S of Tamazunchale, 9 July 1966, Mears 454a (TEX); Rascón, 19-22 June 1905, Palmer 651 (GH, NY); wet places, Las Canoas, 19 Aug 1891, Pringle 3806 (C, CAS, DUKE, F, GH, L, LL, LY, MICH, NY, TEX, UC); Villa de Reyes, 16 Nov 1956, Rzedowski 8510 (ENCB); 2 km al SSE de Ojo de Agua, mpio. de Alaquines, 9 Feb 1959, Rzedowski 9669 (ENCB); Las Canoas, mpio. de Cárdenas, 12 Sep 1967, Rzedowski 24507 (ENCB). GUANAJUATO: Moro León, Feb 1898, Duges 3 (GH). SINALOA: Culiacán, 27Aug-15 Sep 1891, Palmer s.n. (US); vicinity of Labradas, 20 Sep 1925, Ferris \& Mexia 5188 (CAS, DS). NAYARIT: 12 mi SE of Tepic, and nearly S of Cerro Sanganguey, 16-18 Aug 1959, Feddema 590 (DUKE, MICH); Tepic, 5 Jan-6 Feb 1892, Palmer 1540 (C, GH, MICH, US). MICHOACAN: Morelia, La Huerta, 15 Oct 1909, Arsène s.n. (C). ESTADO DE MEXICO: Dist. Tuxtepec, Chiltepec, 18 Aug 1941, Martínez-Calderón 569 (MICH); Minatitlán, 30 June 1892, Smith 799 (MO). VERACRUZ: region of San Andrés Tuxtla, near Los Mangos, 19 Aug 1953, Dressler \& Jones 118 (BM, F, GH, MICH, MO, NY, UC, US); Mpio. Jesús Carranza, between Jesús Carranza and Suchilapan, 25 Jan 1943, Gilly 44 (MICH, MSC); Hacia Plan de las Hayas, km 739-761, 13 Aug 1969, Lot 441 (F, GH); Córdoba, Aug 1936, Matuda 302 (GH, MICH); Sanborn, 4 Mar 1910, Orcutt 3059 (DS, MO); 3 km W of Nanchital, vicinity of Coatzacoalcos, 28 June 1960, Rzedowski 23471 (ENCB); mpio. de Catemaco, Sontecomapan, 5 Aug 1965, Rzedowski 20361 (DS, ENCB, LL, MICH); Ejido de Ixtacapa Chico 1 km SW of Campo Experimental de Hule, El Palmar, Zongolica, 13 Aug 1944, Santos 3286 (MICH, TEX). OAXACA: Lacoba, 184 , Galeotti 1866 (GH, MICH); 10 km S of Matías Romero, 27 July 1958, King 855 (ENCB, LL, MICH, TEX, US); between Lacoba \& Jacotepec, June 1892, Liebmann s.n. (C); Distrito Choapam Yaveo, 12 Mar 1938, Mexia 9129 (B, GH, MO, US); Tehuantepec, 74 km N of Unión Hidalgo, 12 July 1958, Williams, Jr. 15 (ENCB, MICH). CHIAPAS: Mpio. Ostuacán, Presa de Mal Paso, 21 July 1969, Arreguín s.n. (MICH); 10 mi N of Ocozocoautla along road to Mal Paso, Mpio. de Ocozocoaulta de Espinosa, 12 June 1965, Breedlove 10358 (ENCB, NY); Mpio. de Tenejapa, paraje de Mahosik', 8 Aug 1966, Breedlove 14841 (MICH, NY); between Huixtla and Tapachula, 2 Sep 1964, Elias et al. 376 (A); Tapachula, 5 Aug 1935, Fisher 35284 (MO, NY); 1 mi N of Acacoyagua, 1 June 1973, Hansen \& Nee 1629 (LL); Palenque ruins, 3 July 1969, Marcks \& Marcks 956 (LL); Palenque, 6-9 July 1939, Matuda 3629 (GH, LL, MICH). TABASCO: near Alemán, 15 km NW of Cárdenas, 10 May 1963, Barlow 26/12 (MICH); about 25 km W of Huimanguillo, 28 May 1963, Barlow 30/135 (BM, GH), 30/137 (DS, UC); Emiliano Zapata, 26 May 1964, Cota G. s.n. (ENCB); Sebastián, 8 June 1889, Rovirosa 498 (UC). YUCATAN: Uxmal, 20-21 July 1932, Swallen 2588 (MICH, US).

GUATEMALA: ALTA VERAPAZ: vicinity of Cubilguitz, 1 Mar 1942, Steyermark 44364 (MICH); no locality, July 1907, Turckheim 11128 (GH, L, LY, MO, NY, US). IZABAL: Gualán, 13 Jan 1905, Deam 437 (GH, MICH, MO); Quebradas, 18 May 1919, Pittier 8552 (US); Zapatillo, Lake Izabal, 21 June 1966, Snedaker D-101 (F, GH); vicinity of Quiriguá, 15-31 May 1922, Standley 23733 (GH, NY, US), 26-27 Apr 1939, Standley 72488 (MICH).

BRITISH HONDURAS: BELIZE: Sibun River, 1 mi beyond Hattieville, 27 July 1971, Dieckmann S. J. 314 (MO); Belize, 15 Mar 1933, Lundell 1930 (MICH); 3 mi N of Sibun River, 9 mi S of Belize, 24 Aug 1936, O'Neill 8989 (C, CAS, MICH, NY, UC). EL CAYO: San Antonio, 6 May 1931, Bartlett 13073 (MICH); Prospecto-Maskalls Rd, Nov 1933, Gentle 889 (B, C, MICH, MO, NY, UC); Augustine, Mountain Pine Ridge, by Rio Frio near Hydram, 13 Dec 1959, Hunt 254 (BM, LL, US); Boomtown, 11 Sep 1936, O 'Neill 8988 (C, CAS, GH, MICH, US).

EL SALVADOR: SANTA ANA: no locality, 1924, Calderón 2197 (US).
HONDURAS: ATLANTIDA: Lancetilla Valley, near Tela, 6 Dec 1927-20 Mar 1928, Standley 53393 (US), 53737 (US); between Tela and Lancetilla, 13 July 1934, Yuncker 4583 (MICH, MO); vicinity of La Ceiba, 12 July 1938, Yuncker et al. 8364 (BM, GH, MICH, MO, NY, UC, US). EL PARAISO: near Ojo de Agua, 11 Aug 1946, Williams \& Molina R. 10294 (LL, MICH, UC). MORAZAN: Jicarito River, 24 June 1948, Glassman 1739 (GH, NY); road between El Jicarito and El Pedregal, 13 Nov 1948, Standley 14503 (F); SE of El Zamorano, base of Cerro Majicorán, 2 Aug 1949, Standley 22125a (F). SANTA BARBARA: San Pedro Sula, Apr 1887, Thieme 5563 (US).

NICARAGUA: BLUEFIELDS: Finca Santa Rosa, ca 2.5 km ENE of Rama, Río Escondido, 5 Apr 1966, Proctor et al. 27356 (GH, UC, US). BOACO: 1 km W of Boaca, 30 Dec 1968, Moore 1459 (BM, F, GH, MO, UC). CHONTALES: 5 km SE of Juigalpa, 4 Jan 1969, Atwood 1596 (BM, F, GH, MO, UC); 2 km S of Acoyapa, 4 Jan 1969, Moore 1702 (F, MO). MATAGALPA: toward Tuma, 28 Feb 1971, Svenson 4088 (MICH). RIO SAN JUAN: San Carlos, 10 Jan 1969, Hamblett 2053 (BM, GH). RIVAS: 1 km N of Costa Rican boundary, 7 Jan 1969, Moore 1824 (F, MO, UC). ZELAYA: Jackson Farm W of Bluefields, 3 Mar 1971, Svenson 4143 (MICH).

COSTA RICA: ALAJUELA: about 7 km E of Ciudad Quesada, 17-18 May 1968, Burger \& Stolze 4949 (ENCB, GH). CARTAGO: Dept. Turrialba, grounds of Instituto Interamericano, 19 June 1947, DeWolf 116 (NO); vicinity of Pejivalle, 7-8 Feb 1926, Standley \& Valerio 46860 (US).

GUANACASTE: 9.5 mi S of Nicaraguan border, near old road from Pena Blanca to La Cruz, 6 Aug 1946, Morley 760 (UC). HEREDIA: La Selva, nr Puerto Viejo, 19 May 1972, Opler 801 (F). LIMON: 2 km E of Siquirres, 20 Nov 1968, Davidse \& Pohl 1361 (MO); 6 mi inland from mouth of Estrella River, 1952, Stork 4636 (MICH, UC). PUNTARENAS: Osa Peninsula, Rincón, 19 July 1968, Davidse \& Pohl 1146 (MO). SAN JOSE: vicinity of El General, July 1936, Skutch 2736 (GH, MICH, NY, US).

PANAMA: BOCAS DEL TORO: Lagunas de Chiriquí, Nov-Dec 1885, Hart 80 (US); junction of Ríos Changuinola and Tereba, 17-19 Dec 1966, Lewis et al. 959 (GH); Chiriquicito to 5 mi S along Río Guarmo, 5-7 June 1967, Lewis et al. 2007 (DUKE, UC). CANAL ZONE: Victoria Fill near Miraflores Locks, 6-14 Mar 1939, Allen 1716 (GH, US); Colón, 7 May 1971, Correa \& Dressler 1744 (F); between Gorgona and Tabernilla, 15 Sep 1911, Hitchcock 8106 (US); Barro Colorado Island, 1 Aug 1927, Kenoyer 150 (US); around Porto Bello, 17-18 Jan 1911, Pittier 2466 (US); around Culebra, 6 May 1911, Pittier 3444 (US); Las Cascadas Plantation near summit, 2 Dec 1923, Standley 25794 (US). COCLE: mountains above El Valle, 10 June 1967, Stimson 5009 (DUKE). DARIEN: 4 mi up river from Santa Fe, 30 Sep 1961, Duke 4164 (UC). HERRERA: vicinity of Las Minas, 22 Feb 1963, Stern et al. 1800 (MICH, US). PROV. DE PANAMA: Mt. Vernon, Caladonia Harbor, 3 Apr 1939, Elmore 67 (MICH, UC); Los Santos, Loma Prieta, Cerro Grande, 8 June 1967, Lewis et al. 2237 (UC); Juan Díaz region, near Tapia River, 1-3 June 1923, Maxon \& Harvey 6757 (UC, US).

WEST INDIES: CUBA: PINAR DEL RIO: Mendoza, 16 Nov 1923, Ekman 18084 (NY).
JAMAICA: ST. CATHERINE: no locality, 8 June 1915, Harris 12064 (BM, CAS, MO, NY); near Salt Ponds, 27 Dec 1915, Harris 12304 (BM, MO, NY, UC); Warwick Castle farm, 23 Aug 1961, Powell 992 (BM).

DOMINICAN REPUBLIC: SAMANA: Samaná and vicinity, 13 Mar 1928, Miller 1101 (CAS). DISTRITO NACIONAL: Santo Domingo, 9 Aug 1973, Liogier 19897 (NY).

GUADELOUPE: Embouchure de la Grande Rivière de Deshaies, 21 Mar 1936, Stehle 2872 (UC).

DOMINICA: Portsmouth, between Prince Rupert Bay and Doublas Bay, 1 Aug 1938, Hodge 251 (BM); near Pointe St. Michel, Nov 1881, Eggers 535 (L, M); about 2.5 mi N of Pont Cassé, 16 July 1964, Wilbur et al. 7555 (DUKE, F, NY, TEX).

MARTINIQUE: Saint Esprit Campfleue, 1880, Duss $705 a$ (C, F, LY, NY).
ST. LUCIA: Quilesse, 23 May 1945, Beard 1035 (MO); Port Castries, 1 Dec 1887, Lee s.n. (GH); SE of Piton Troumassée, 22-23 Apr 1959, Proctor 17713 (BM).

ST. VINCENT: Charlotte Parish, on slope of Mt. Brisbane, 12 Apr 1962, Cooley 8630 (DUKE).

GRENADA: Belvedere, 30 Oct-11 Dec 1957, Proctor 16985 (BM).
TRINIDAD: Government Forest Reserve, 29 May 1925, Broadway 5675 (F, MO, UC); St. Joseph Stock Farm, Pangola pasture, 10 July 1958, Purseglove 6174 (L).

TOBAGO: Botanic Station, 5 Apr 1909, Broadway 2988 (F, L, MO).
SOUTH AMERICA: COLOMBIA: ANTIOQUIA: Medellín, 21 Dec 1943, Bernal 66 (MO). BOLIVAR: vicinity of Turbaco, 22 Nov 1926, Killip \& Smith 14461 (GH); Tierra Alta, Río Sines, $7-10$ Mar 1918, Pennell 4685 (GH). CHOCO: Bahỉa Solano, 4 Jan 1973, Gentry \& Forero 7190 (F). HUILA: Mpio. Santa María, 22 June 1967, Plaxton s.n. (MICH). SANTANDER: region del Sarare, hoya del Río Cubugón, junto a la Quebrada de Gibraltar, 15 Nov 1941, Cuatrecasas 13212 (F); Puerto Wilches and vicinity, 28 Nov-2 Dec 1926, Killip \& Smith 14772 (GH). VALLE DEL CAUCA: La Trojita, 19 Feb-10 Mar 1944, Cuatrecasas 16426 (F); Timba, 3 Mar 1937, Sneidern 1124 ( $\mathrm{F}, \mathrm{GH}$ ).

VENEZUELA: AMAZONAS: Rio Orinoco, Boca del Vichada, 12-24 Jan 1930, Holt \& Gehriger 225 (B); Maroa, 10 Feb 1942, Williams 14246 (F). BOLIVAR: Río Paragua, Guaiquinima, $14-15$ Apr 1943, Killip 37450 (BM, F). CARABOBO: Guaremales, road from Puerto Cabello to San Felipe, 25 July 1920, Pittier 8891 (GH). MIRANDA: Parque Nacional de Guatopa, between Santa Teresa and Altagracia de Orituco, 14.5 km from Los Alpes, 23 Nov 1961, Steyermark 89946 (B). TACHIRA: Colincho, San Félix, 16 May 1917, Curran \& Haman 1016 (GH). TERRITORIO DELTA AMACURO: no locality, 14 Nov 1960, Steyermark 87529 (GH).

GUYANA: EAST DEMERARA: Georgetown, wild land in Botanic Garden, 24-26 Oct 1919, Hitchcock 16543 (GH). ESSEQUIBO: Mora Landing, 21-23 Aug 1922, de la Cruz 1837 (BM, F, GH, UC); Pomeroon River, 17-24 Dec 1922, de la Cruz 3206 (GH, MO, UC); 1 mi S of Thern, Essequibo, 16 Apr 1956, Irwin 969 (TEX). MAZARUNI-POTARO: $12-15 \mathrm{mi}$ from Bartica, 28 Aug 1935, Potter 5294 (GH).

SURINAM: NICKERIE: Wilhelmina Gebergte, Zuid River, Kayser Airstrip, 45 km above confluence with Lucie River, 27 Sep 1963, Irwin et al. 57677 (GH, MICH, MO). PARAMARIBO: 3 km N of Paramaribo, 5 Apr 1944, Maguire \& Stahel 22730 (GH, MICH).

FRENCH GUIANA: CAYENNE: vicinity of Cayenne, 24 June 1921, Broadway 566 (GH), 4 July 1921, Broadway 646 (GH), no date, Jelski s.n. (GH).

ECUADOR: ESMERALDAS: Placa Rica, 6 Dec 1963, Mexia 8408 (B, BM, F, GH, MO, UC). IMBABURA: Lita, 28 May 1949, Acosta Solís 12549 (F). NAPO: Tena, 1 Oct 1939, Asplund 8961 (CAS). PASTAZA: Mera, 30 Jan 1956, Asplund 19143 (LL); near Puyo, 18-20 Feb 1935, Mexia 6918 (B, F, GH, UC). PICHINCHA: wet places near Las Palmar Station, 2-5-58, Prescott 1266 (MSC); Nanegalito, 15 July 1950, Acosta Solis 17153 (UC).

PERU: HUANUCO: Bosque Nacional de Iparia, cerca del pueblo de Tournavisto, 2 Mar 1967, Schunke 1705 (F). LORETO: about 40 km from Tingo Maria on highway to Pucallpa, 1 Nov 1949-5 Jan 1950, Allard 20392 (UC); Pucallpa, 30 Oct 1947, Fosberg 28889 (L); Caballo-Cocha on the Amazon River, Aug 1929, Williams 2280 (GH). SAN MARTIN: NE of Tarapoto, 21-22 Aug 1937, Belshaw 3293 (DUKE, F, GH, LL, MO, UC); Tarapoto, 11 Feb 1947, Woytkowski 35054 (BM, F, MO, UC).

BOLIVIA: COCHABAMBA: 130 km NE of Cochabamba, 9 Mar 1939, Eyerdam 24717 (UC). LA PAZ: Mapiri, Charopampa, Nov 1907, Buchtien s.n. (LY); Mapiri, Apr 1886, Rusby 154 (MICH). PANDO: Trinidad, Aug 1944, Cárdenas 3528 (GH). SANTA CRUZ: no locality, 27 Dec 1924, Steinbach 6832 (B).

BRAZIL: AMAPA: Rio Araguari, 11 Sep 1961, Rodrigues \& Irvine 50857 (UC). AMAZONAS: Barcellos, Rio Negro, 9 Feb 1944, Baldwin 3323 (F); Benjamin Constant, Alto Solimões, 7.9.62, Duarte 6863 (M); Manaus, Jan 1932, Lako 131 (B). CEARA: Grangeiro Taboleiros, Mar 1935, Luetzelburg 24511 (F, MICH). MARANHAO: about 35 km S of Loreto, 23 Mar 1962, Eiten \& Eiten 3748 (L). MINAS GERAIS: Nr. Lagôa Pampulha, Municipio of Belo Horizonte, 8 Mar 1945, Williams \& Assis 6052 (GH); in Belo Horizonte, 11 June 1945, Williams \& Assis 7217 (GH). PARA: Belém, Mar-May 1929, Dahlgren \& Sella 602 (GH); mun. de Belém, about Lagôa Agua Preta, 29 June 1935, Drouet 1936 (F, GH, MICH); Fazenda Camburupy, Ilha de Marajó, 19-20 June 1934, Swallen 4948 (MICH). PERNAMBUCO: Tapera, 28 June 1933, Pickel 2806 (DS, GH, MICH, MO). RIO DE JANEIRO: Rio de Janeiro, Serra de Carioca, 19 Nov 1928, Smith 1345 (GH). RIO GRANDE DO SUL: Santa Maria, 10 Mar 1956, Camargo 59326 (B); Pôrto Alegre, São Leopoldo, 7 Jan 1937, Orth 692 (C, GH, UC); Guáiba, 24 Jan 1949, Rambo S. J. 40127 (B); Pôrto Alegre, Jan 1899, Reineck \& Czermak 215 (M). SANTA CATARINA: Itajaí, 26 Nov 1961, Klein \& Barros 2.819 (B,L); Três Barras, S. Francisco do Sul, 21 Jan 1958, Reitz \& Klein 5.235 (B, UC). SAO PAULO: municipio de Moji-Guaçu, Fazenda Campininha, 8.5 km NNE of Padua Sales, 18 Apr 1961, Eiten \& Eiten 2672 (F).

PARAGUAY: GUAIRA: Villarica, 1930, Jörgensen 22269 (GH). MISIONES: Santiago, 21 Apr 1961, Pedersen 5038 (C) 5938 (L). SAN PEDRO: Carumbé, 29 Nov 1969, Pedersen 9435 (C, L). DEPT. UNKNOWN: Central Paraguay, 1888-1890, Morong 244 (BM, GH, UC); Ytororó, 11 Dec 1969, Pedersen 9529 (C, L, UC), 9531 (C, L).

URUGUAY: TREINTA Y TRES: Vergara, M Dec 1932, Herter $1617 a$ (F).
ARGENTINA: BUENOS AIRES: San Fernando, 11 Apr 1969, Pedersen 9097 (C, L, UC). CHACO: Machagay, 8 May 1945, Meyer 9865 (F). CORDOBA: Alto Alegre, Jan 1941, Ousset 22 (GH). CORRIENTES: Paso de los Libres, Paso Troncón, 16 Dec 1946, Huidobro 3765 (CAS); camino a San Carlos, 11-13 Feb 1971, Krapovickas et al. 18108 (LL, MO, UC); Mburucuyá, Santa Teresa, 14 Feb 1951, Pedersen 1015 (C); Depto. Empedrado, Estancia "La Yela," 25 Nov 1957, Pedersen 4668 (C, MO, UC); Depto. Mburucuyá, Santa María, 18 Jan 1960, Pedersen 5333 (A, C, UC). ENTRE RIOS: Colonia Elía, 2 Feb 1967, Pedersen 8031 (C); Depto. Federación, Estancia "Buena Esperanza," 28 Mar 1967, Pedersen 8155 (C, L, UC), 6 Apr 1971, Pedersen 9810 (C); 12 km E of Ceibas, 8 Feb 1973, Pedersen 10294 (C). FORMOSA: Depto. La Paz, en divisío de la Ruta 126 a Bovril, 16 Mar 1962, Burkart et al. 23.282 (BM); Depto. Pirané, sur de Casco Cué, 20 Feb 1946, Morel 977 (CAS); in regione inferioris fluminis Pilcomayo, May 1906, Rojas 162 (BM). JUJUY: 17 km W of San Pedro de Jujuy, 13 Oct 1938, Eyerdam \& Beetle 22557 (UC). MISIONES: Santa Ana, 7 Jan 1913, Rodriguez 700 (GH). SALTA: Depto. Cerrillos, 2 Nov 1941, Meyer 3584 (GH). TUCUMAN: no locality, Dec 1872-Jan 1873, Lorentz \& Hieronymus s.n. (B).

Cyperus ochraceus Vahl, Enum. Pl. 2: 325. 1806. Type: St. Croix, West 15 (C!, holotype). Figure 5 (A-D).

Cyperus ochraceus Vahl var. excelsior Kukenthal, Pflanzenreich IV. 20 (Heft 101): 182. 1936. Type: Bolivia, Villa Montes, Prov. Tarija, 1911, K. Pflanz 651 (B!, lectotype); Puerto Rico, P. E. Benzon s.n. (not A. Benzon as cited in Das Pflanzenreich) (C!, paratype).

Cyperus ochraceus Vahl var. minor Kükenthal, Pflanzenreich IV. 20 (Heft 101): 182. 1936. Type: Puerto Rico, "bei Guanica am Rand einer Lagune," Sintenis 3839 (B!, holotype).

Tufted perennial up to $50(-80) \mathrm{cm}$ tall; stems erect, stiff to flexuous, round or obtusely triquetrous, smooth, green, light green, or stramineous, $1-2.5 \mathrm{~mm}$ wide distally, $1-5 \mathrm{~mm}$ wide at the base; leaves $3-11$, mostly shorter than the stem but some exceeding the compound inflorescence, $14-30 \mathrm{~cm}$ long; leaf sheath $2-10 \mathrm{~cm}$
long, brown, or stramineous, with red glands adaxially (especially on the membranous portions), without transverse septa between the red veins, sometimes persistent and becoming dark brown and partially fibrous the second year; leaf blade $1.5-4 \mathrm{~mm}$ wide at mid-length, usually flat, light to dark green, attenuate at apex; involucral bracts $4-8$, foliaceous and spreading, $10-33 \mathrm{~cm}$ long, $2-6 \mathrm{~mm}$ wide, sheathless or with a sheath less than 2 mm long, usually flat, without transverse septa between the veins, apically attenuate; compound inflorescence $2-10(-20) \mathrm{cm}$ long; primary peduncles up to 13 or absent, $1.5-9(-16) \mathrm{cm}$ long, $0.5-0.8 \mathrm{~mm}$ wide, round, smooth, stiff to flexuous; secondary peduncles absent or $1-6$, up to 2.5 cm long, ca 0.5 mm wide, straight; heads hemispherical, the primary ones $17-30 \mathrm{~mm}$ wide and with (4-) 10-26 spikelets, the secondary ones $12-20 \mathrm{~mm}$ wide and with $4-15(-25)$ spikelets; bracteoles ovate, $2-2.5 \mathrm{~mm}$ long, $5-9$-veined, coriaceous or membranous, apically attenuate; prophyll of spikelet $0.5-1.5 \mathrm{~mm}$ long, membranous, 3 -veined; spikelets oblong, (5-) $7-10(-35) \mathrm{mm}$ long, $2-3 \mathrm{~mm}$ wide, apically acute, with (10-) $18-26$ ( -88 ) scales; rachilla $0.3-0.4 \mathrm{~mm}$ wide, ca 0.15 mm thick, straight or slightly arched, green to reddish brown, the transverse scale scars $0.5-0.8 \mathrm{~mm}$ apart on each side; scale angles $\left(45^{\circ}-\right) 60^{\circ}-90^{\circ}$; scales ( $1.2-$ ) $1.5-2 \mathrm{~mm}$ long, $1.2-2 \mathrm{~mm}$ wide, or $0.6-0.7 \mathrm{~mm}$ wide and either triangular or lunate in lateral view, adaxially with red to reddish brown glandular, longitudinal striations, apically acute and straight or slightly incurved, distinctly bicarinate basally, the proximal abaxial groove between the two keels $0.6-1.5 \mathrm{~mm}$ long; medial part of scale subcartilaginous or chartaceous, greenish brown to dull white, barely scabrellate distally; sides of scale membranous or chartaceous and reticulate with large cells, usually becoming glossy with maturation, golden brown or dark yellow, the margins revolute on the upper two-thirds to three-fourths of the scale, basally attached to the rachilla for 0.4 mm leaving ca 0.2 mm free on each side; stamen solitary, $1.5-2 \mathrm{~mm}$ long, the filament $1.2-1.5 \mathrm{~mm}$ long, the anther $0.8-1.2 \mathrm{~mm}$ long; pollen $25-30 \mu$ in diameter; style $0.6-1.2 \mathrm{~mm}$ long, the stigmatic branches $0.3-0.6 \mathrm{~mm}$ long; achene filling two-thirds to three-fourths of the scale, bilaterally symmetric or slightly asymmetric, black or blackish brown, broadly trigonous, obtusely angled, about two times longer than wide, $1-1.5 \mathrm{~mm}$ long (total length), the stipitate base less than 0.1 mm long, the body $0.9-1.2 \mathrm{~mm}$ long, and the slender apical beak as much as 0.5 mm long; achenial surfaces equal in width, $0.4-0.5(-0.6) \mathrm{mm}$ wide, narrowly ovate, generally convex or planar, or the abaxial surfaces planar on the lower one-half and convex on the upper one-half.

Distribution. Known from the Greater and Lesser Antilles and from Louisiana and Texas south through Mexico and Central America, and in Colombia, Venezuela, and Argentina. In sandy, silty, or clayey soils of ditches, fields, pastures, swamps, lava flows, cleared depressions of pine-oak forests or subtropical forests, and near lakes or streams, from sea level to 2350 meters in elevation (Fig. 10).

Discussion. The strong reflexion of the scales from the rachilla provides one of the most distinctive features of C. ochraceus. Other distinguishing characters are oblong spikelets, scales with straight or subtly incurved apices, and broadly trigonous, obtusely angled achenes. The achenes are usually bilaterally symmetric but may be asymmetric when one of the abaxial surfaces is planar proximally and convex distally, thus creating a hump on the upper part of one of the abaxial surfaces.

The spikelets of C. ochraceus usually appear interrupted, a condition caused by the long internodes of the rachilla. The scales are widest just above the base, and only about one-half of each side is attached basally. The distinctive free parts, ca 0.2 mm on each side, tend to give the appearance of flaps or auricles. The scales may appear roughened, with reticulate cells, or smooth and glossy, but this variation is not useful to denote infraspecific ranks; often both of these conditions are visible on one spikelet. One specimen from Uvalde County, Texas (Correll \& Correll 26159), has large


Figure 10. Distribution of Cyperus intricatus and C. ochraceus.
spikelets, $24-35 \mathrm{~mm}$ long, consisting of $60-88$ scales. Other than for the increased size of the spikelets, the specimen is typical C. ochraceus. Larger than average spikelets, $25-30 \mathrm{~mm}$ long, are also found on a collection from Provincia Salta, Argentina (Beetle 22637).

The stems of $C$. ochraceus are about the same size as those of $C$. luzulae but smaller than those of C. eragrostis, C. distinctus, and C. virens. The lack of transverse
septa and the nodulose condition of the foliage leaves and involucral bracts serve to separate C. ochraceus from C. virens and C. eragrostis, and sometimes from C. acuminatus and $C$. luzulae. The achenes of $C$. ochraceus may be confused with those of $C$. eragrostis but are different in that they are obtusely rather than acutely angled, planar or convex rather than concave, and ovate rather than obovate.

## Representative specimens:

UNITED STATES OF AMERICA: LOUISIANA: IBERIA PARISH: N side of New Iberia, 10 July 1969, Thieret 31604 (DUKE, LL).

TEXAS: BEXAR CO: San Antonio, 15 June 1911, Clemens \& Clemens 402 (MICH), 7 July 1911, Clemens \& Clemens 404 (UC), 18 June 1941, Metz s.n. (UC). BRAZORIA CO: 3 mi W of Angleton, Oyster Creek, 2 July 1963, Correll et al. 28175 (LL); Cocklebur Slough on San Bernard Refuge, 11 Aug 1969, Fleetwood 9530 (TEX); Angleton, 6 July 1972, Fleetwood 10098 (MO). CALHOUN CO: $15 \frac{1}{4} \mathrm{mi}$ SW of Port Lavaca, 24 Nov 1945, Cory 51146 (LL). CAMERON CO: Brownsville, 21 Apr 1933, Clover 981 (TEX), 22 June 1922, Tharp 1136 (TEX); about 2 mi S of San Benito, 13 July 1957, Correll \& Johnston 17920 (LL, UC); 2 mi NW of Olmito, 1 June 1938, Runyon 1823 (MICH, TEX, UC). FORT BEND CO: near Thompsons, 5 Oct 1965, Correll 31864 (LL). HARRIS CO: Houston, 10 July 1937, Fisher s.n. (C, CAS, DS, DUKE, MICH, TEX, UC). HIDALGO CO: Santa Ana National Wildlife Refuge, at edge of East Lake, 5 June 1970, Correll \& Correll 38865 (LL); about West Lake, Santa Ana Wildlife Refuge, 12 June 1963, Correll \& Wasshausen 27686 (LL, UC), La Joya Lake, 8 June 1941, Runyon 2757 (TEX, UC); 10 mi W of Santa Maria, 25 May 1946, Walcott \& Barkley 16 T 361 (TEX, UC). JACKSON CO: Lavaca River, 27 Aug 1941, Tharp s.n. (MO, TEX). JIM WELLS CO: Along Old Alice Road, near Alice, 1 Nov 1942, Freeborn \& Freeborn 193 (BM, TEX). KARNES CO: 1 mi SW of junction of Texas hwy. 123 and Farm-to-Market Road 81, Panna Maria, 12 June 1953, Johnson 1235 (TEX). KLEBERG CO: 4 mi NE of Kingsville, 28 Nov 1945, Cory 51288 (LL). LIBERTY CO: Trinity River bottomland about 1 mi E of Dayton, 25 Oct 1967, Correll 35279 (LL). MATAGORDA CO: Bay City, 7 Aug 1918, Fisher s.n. (MICH, MO, UC). MAVERICK CO: 8 mi S of Eagle Pass, 22 Sep 1962, Anda et al. 8363 (TEX). NUECES CO: SE of Corpus Christi, 21 Aug 1963, Correll \& Correll 28502 (LL, UC); about 5 mi S of Banquete, 30 Nov 1954, Johnston 542270 (LL, TEX); Agua Dulce Creek bottom near highway 44, 29 Nov 1954, Johnston 542313 (TEX). SAN PATRICIO CO: 6 mi NW of Taft, 22 Nov 1962, Sanchez 49 (TEX); along shores of lake in Corpus Christi Lake State Park, 13 June 1947, Webster \& Rowell 7083 (ENCB, TEX); Welder Wildlife Refuge, 28 Aug 1957, Williges Sn 4 (TEX). STARR CO: U.S. Highway 83-below Falcon Dam, 27 Oct 1962, Gongora et al. 8459 (LL, TEX). SWISHER CO: Tule Lake near Tulia, 1926, Tharp s.n. (MICH). UVALDE CO: about 1 mi N of Uvalde, along route 83, 2 Oct 1969, Correll 38063 (LL); Blewett, 2 Oct 1962, Correll \& Correll 26159 (LL); Memorial Park, Uvalde, 15 Aug 1937, Cory 23832 (GH); 12 mi SE of Uvalde, 15 Aug 1937, Cory 23833 (GH); Uvalde, 14 Oct 1916, Palmer 11033 (BISH, DS); near Uvalde, springy banks of Nueces River, 24 Sep 1918, Palmer 14487 (B, MO). Webb CO: Lake Casa Blanca, 6 mi E of Laredo, 10 Oct 1961, Pena, Jr. 33-d (TEX), 25 Nov 1962, Ramirez 5 (TEX). WILLACY CO: $21 / 4 \mathrm{mi} \mathrm{N}$ of Raymondville, 2 Dec 1945, Cory 51466 (LL); Raymondville, 18 Oct 1938, Runyon 1920 (TEX, UC).

MEXICO: COAHUILA: Sabinas River, Muzquiz, 11 July 1936, Marsh 401 (TEX); Múzquiz Swamp, 15 Sep 1936, Marsh 889 (GH, TEX). NUEVO LEON: Monterrey, 16 June 1930, Arsène s.n. (B), July 1911, Arsène 6122 (US), 12 Aug 1930, Fisher 6 (US); Ojo de Agua Nogolar, 5 mi N of Monterrey, 18 Aug 1944, Hernández Corzo \& Barkley 14590 (TEX); Monterrey Country Club, 10 Oct 1937, Kenoyer 321 (F). TAMAULIPAS: Sierra de San Carlos near Tangue, vicinity of El Mulato, 16 Aug 1930, BArtlett 10975 (F, MICH); 3 mi SW of El Canelo, 9 Feb 1960, Crutchfield \& Johnston 5080 (MICH, TEX); 10 mi E of Ciudad Mante, 31 Aug 1948, Kenoyer \& Crum 3666 (MICH); ca $4-5 \mathrm{mi} \mathrm{S}$ of Ciudad Mante, 18 Feb 1961, King 3812 (F, MICH, TEX, UC, US); N of Tampico near Barranco, $3 / 8 / 39$, LeSueur 16 (TEX); 16.1 mi N of Cd. Victoria on Hwy. 101 towards Matamoros, 11 July 1966, Mears $524 a$ (TEX); 15 km al W de Tampico 4 Feb 1968, Saucedo s.n. (ENCB). SAN LUIS POTOSI: Mpio. El Pujal, Valley of Río Tampaón, 19 July 1939, Chase 7499 (GH, MICH); Micos, 19 July 1933, Fisher 331 (GH, US); 12 mi E of Valles, 9-5-48, Kenoyer \& Crum 3871 (MICH); wet places, Las Canoas, 17 June 1891, Pringle 3724 (ENCB, F, GH, M, MICH, UC, US); 3 km al W de Huichihuayan, 3 May 1959, Rzedowski 10439 (ENCB); Las Canoas, Mpio. de Cárdenas, 12 Sep 1967, Rzedowski 24537 (ENCB); Mpio. de Cárdenas, Poza Azul, cerca de Canoas, $12-15$ Sep 1967, Rzedowski 24773 (DS, ENCBB). JALISCO: 1 mi W of Ayo el Chico, 23 Aug 1958, McVaugh 17221 (ENCB, MICH). MICHOACAN: $11-13 \mathrm{~km}$ WSW of Apatzingán, along the road to Dos Aguas and Aguililla, Dieterle 4256 (MICH); Tancítaro Region, municipality Apatzingàn, 7 Aug 1941, Leavenworth \& Hoogstraal 1357 (F, GH, MICH). GUERRERO: 2 mi S of Acahuizotla, 16 July 1952, Rowell, Jr. 3085 (MICH); cerca de Mazatlán, Mpio. de Chilpancingo, 9 Oct 1969, Rzedowski 26885 (ENCB). ESTADO DE MEXICO: nr.

México, June 1907, Arsène s.n. (L); Tonatico, Piedras Negras, 15 Nov 1953, Matuda et al. 30099 (DS); 1 mi W of Progreso, 14 Aug 1950, Pipes 142 (MICH). MORELOS: 20 km NE of Cuautla, Boyd 58 (MICH). HIDALGO: 4 km SE of San Bartolo Tutotepec, 3 June 1972, Leyra 639 (ENCB); 4 km al W de Tolcayuca, 23 Aug 1970, Quezada 1123 (ENCB). PUEBLA: Mpio. de Agua Fría, 20 May 1969, Puig 4671 (ENCB). VERACRUZ: 2 km al N de Casitas, cerca de Nautla, 21 Apr 1968, Gutierrez 242 (ENCB); 7 km al S de Tecolutla, Riachuelos, 5 May 1968, Gutierrez 301 (DS, ENCB, MICH); El Palmar, Zongolica, $23 \mathrm{~km} N$ of Campo Exp. de Hule, 7 May 1944, Santos 2949 (MICH). OAXACA: Cuicatlán, 2 Dec 1897, Conzatti \& Gonzalez 657 (GH, US); 2 km W of Juchitán on Pan-Am hwy, to Tehuantepec, 4 July 1969, Marcks \& Marcks 986 (LL). CHIAPAS: Amatengo del Valle, 27 July 1966, Breedlove 14677 (ENCB, LL, MICH, NY). TABASCO: Tenosique, Bosa Cerro, 1-5 July 1939, Matuda 3578 (GH, MICH). CAMPECHE: Tuxpeña, 11 Oct 1931, Lundell 803 (DS, F, GH, MICH, UC, US); Champotón, 7-15 July 1932, Steere 1970 (MICH), 1973 (MICH). YUCATAN: Izamal, no date, Gaumer 1028 (GH, UC); Progreso, 11-15 Aug 1932, Swallen 2963 (MICH, US). QUINTANA ROO: Caleta, Cozumel, 18 Feb 1899, Millspaugh 1519 (F); San Miguel, Cozumel Island, 6-8 Aug 1932, Swallen 2093 (MICH), 2906½ (MICH, US).

BRITISH HONDURAS: Maskall, northern river, Dec 1933, Gentle 1018 (CAS, GH, MICH, UC); San Andrés, Corozal, 6 July 1933, Lundell \& Gentle 4810 (B, CAS, DS, L, MICH, TEX, UC, US, WTU); along New River, Orange Walk, 8 Sep 1936, O'Neill 8980 (C, CAS, DS, DUKE, F, GH, MICH, TEX, UC, US).

GUATEMALA: HUEHUETENANGO: Ciénaga de Lagartero, below Miramar, 29 Aug 1942, Steyermark 51547 (F). IZABAL: about 15 km N of Quiriguá, 28 May 1922, Standley 24643 (GH, US). PETEN: Ruinas Plaza Mayor Tikal, 16 Nov 1965, Molina R. 15828 (F).

HONDURAS: ATLANTIDA: Lancetilla Valley, near Tela, 6 Dec-20 Mar 1928, Standley 55757, 55764 (both US). COMAYAGUA: vicinity of Comayagua, 12-23 Mar 1947, Standley \& Chacón 5996 (F). CORTES: vicinity of La Lima, 11-20 Apr 1947, Standley \& Chacón 7235 (F).

NICARAGUA: MANAGUA: Tule region of Managua, vicinity of Managua, July 1932, Garnier 787 (US); Managua, no date, Garnier 4450 (GH). RIVAS: puente las Cabezas, route 2, NW of Belén, 7 Jan 1969, Moore 1928 (BM, GH).

PANAMA: DARIEN: 3 mi N of Santa Fe, 15 July 1966, Tuson et al. 4613 (GH).
BAHAMAS: NEW PROVIDENCE: Nassau, 2 May 1903, Curtiss 210 (L, LY), 15 Jan 1890, Northrop \& Northrop 144 (F).

CUBA: ORIENTE: Renté, Santiago, June 1943, Clemente 2881 (GH); road from Mayarí to Cueto, 19 Oct 1941, Morton 3307 (UC, US). SANTA CLARA: Guantánamo Bay, 17-30 Mar 1909, Britton 2072 (US); $11 / 2 \mathrm{mi}$ W of Manacas, Aug 1940, Hodge \& Howard 4258 (A, DUKE); Cienfuegos, Soledad, 21 Aug 1931, Jack 8337 (GH, US); vicinity of Baracoa, 18 Feb-Mar 1910, Shafer 3948 (F, US). SANTIAGO: vicinity of San Luis, 15-18 Feb 1902, Pollard \& Palmer 309 (GH, MO, UC, US).

JAMAICA: HANOVER PARISH: 3112 mi W of Lucea, 9 Sep 1960, Adams 8036 (BM); Eton, Hanover, 24 Jan 1918, Harris 12872 (CAS, F, GH, MO, UC). ST. ANN PARISH: Salem, 17 Apr 1960, Adams 6879 (BM, MO); Roaring River, Mar 1926, Davis s.n. (MICH), 7 Mar 1936, Hunnewell \& Griscom 14121 (GH). ST. CATHERINE PARISH: Charlemont area NE of Ewarton, 23 Jan 1958, Howard \& Proctor 15198 (A); ca 1 mi W of Spanish Town, 15 Nov 1958, Proctor 18344 (BM). ST. JAMES PARISH: near Bickersteth, 1 mi SE of Montpelier, 7 July 1957, Proctor 16459 (BM, MO). ST. MARY PARISH: around Green Castle, 5 July 1963, Crosby et al. 492 (DUKE). ST. THOMAS PARISH: near White Horses, 2 Jan 1958, Yuncker 17897 (BM, MICH). WESTMORELAND PARISH: 1 mi SE of Georges Plain house, 23 July 1966, Proctor 27566 (BM, LL).

HAITI: NORD-OUEST: vicinity of Basse Terre, Tortue Island, 21-29 Mar 1929, Leonard \& Leonard 13985 (GH, MICH, US); vicinity of Louis du Nord, 20 Mar-7 Apr 1929, Leonard \& Leonard 14101 (MO, NY, UC, US). NORD: between Cap-Hä̈tien and Le Borgne, "La Plaine de Port Margot," 19-24 June 1941, Bartlett 17457 (MICH, NY, US). OUEST: Port-au-Prince, Massif de la Selle, Mariani, 17 Oct 1924, Ekman H 2170 (US); vicinity of Pétionville, 15-28 June 1920, Leonard 5085 (NY, US). SUD: between Anse d'Hainault and Dame Marie, southern peninsula, 8 July 1941, Bartlett 17517 (GH, MICH, US).

DOMINICAN REPUBLIC: DISTRITO NACIONAL: vicinity of Ciudad Trujillo, 2 Oct 1947, Allard 18505 (US); Santo Domingo, Llano Castero, shore of Río Ozama, 30 Apr 1929, Ekman 12349 (F, GH, NY), 14 May 1929, Ekman 12471 (A, LL, MICH, UC, US). PUERTO PLATA: Cespitosa, 7 Dec 1952, Jiménez 2510 (US). SAMANA: vicinity of Sánchez, 29 Nov- 12 Dec 1920, Abbott $15 a$ (US). SANTIAGO: vicinity of Santiago, 11 Jan 1946, Allard 14583 (GH, US); Monte Colorado near La Placeta, 28 Sep 1958, Jimenez 3812 (US).

PUERTO RICO: BAYAMON: Bayamón, 1 Feb 1899, Heller \& Heller 409 (C, US); pastures near Bayamón, 2 Nov 1963, Liogier 10339 (GH, US). MAYAGUEZ: Guánica, 2 Feb 1886, Sintenis 3605 (LY, US), 17 Feb 1886, Sintenis 3817 (GH, M). PONCE: 2 mi W of Ponce, 28 Nov 1902, Heller 6145 (GH, MO, US).

ST. CROIX: Orange Grove, 4 Mar 1896, Ricksecker 308 (F, GH, MO, NY, UC); River Estate, 4 Oct 1923, Thompson 378 (GH).

ANTIGUA: Sandersons, 21 Feb 1938, Box 1390 (F, UC).
GUADELOUPE: no locality, 1895, Duss 3654 (C, F, GH, MO, NY).
MARTINIQUE: dans les rues peu frequentés de Sainte-Pierre, Duss 700a (NY).
SOUTH AMERICA: COLOMBIA: BOLIVAR: vicinity of Turbaco, 6-22 Nov 1926, Killip \& Smith 14457 (GH).

VENEZUELA: MERIDA: Brecenio Hacienda, Mar 1931, Reed 664 (B), 12 Feb 1931, Reed 615 (MICH). MIRANDA: Santa Lucia, 6-8 Mar 1943, Killip \& Tomayo 37011 (F).

BRAZIL: MINAS GERAIS: Planalto do Brasil, 15 km N of Montalvania, 18 Mar 1972, Anderson et al. 37168 (NY).

ARGENTINA: SALTA: Depto. Orán, La Cantero camino de Orán Tobacal, 9 July 1946, Borsini 521 (F); Depto. Orán, Tartagal Río, 25 km W of Manuela Pedraza, 26 Oct 1938, Eyerdam \& Beetle 22637 (MO, UC).

Cyperus pseudovegetus Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.]: 24. 1854.
Tufted perennial; stems erect, sometimes flexuous, roundly triquetrous, smooth, grayish green, green, or stramineous, $1-3 \mathrm{~mm}$ wide distally, $2-7 \mathrm{~mm}$ wide at base; leaves $3-12$, one-half as long as to equalling the stem; leaf sheath reddish brown, often with inconspicuous transverse septa between the veins, faintly nodulose, sometimes persistent and becoming dull brown and somewhat fibrous the second year; leaf blade conduplicate or flat, grayish green, green, or stramineous, obtuse to attenuate at apex; involucral bracts usually foliaceous and spreading, sheathless or with a sheath less than 1 mm long, conduplicate or flat, grayish green, green, or stramineous, with inconspicuous transverse septa between the veins, faintly nodulose, apically acute to attenuate; primary peduncles triquetrous or round, smooth, rigid to flexuous; secondary peduncles straight; heads hemispherical or infrequently pyramidal; bracteoles ovate, $2-2.5(-3) \mathrm{mm}$ long, $3-5$-veined, chartaceous, apically attenuate to mucronate; prophyll of spikelet $0.5(-1) \mathrm{mm}$ long, membranous, 5 -veined; spikelets usually broadly ovate, apically obtuse to rounded; rachilla $0.15-0.3 \mathrm{~mm}$ wide, ca 0.1 mm thick, slightly arched, dark reddish brown, the transverse scale scars $0.4-0.5 \mathrm{~mm}$ apart on each side; scales $0.2-0.3 \mathrm{~mm}$ wide and usually falcate in lateral view, adaxially with red glandular, longitudinal striations, distinctly bicarinate basally; medial part of scale subcartilaginous to chartaceous, green to stramineous, barely scabrellate distally; sides of scale membranous and reticulate with large cells, becoming glossy and papyraceous at maturity, the margins hyaline and revolute on the upper one-fourth to one-third of the scale, basally attached to the rachilla for ca 0.2 mm ; stamen solitary; pollen $25-30 \mu$ in diameter; achene dark brown or dark reddish brown, narrowly trigonous, obtusely angled, $1.0-1.5 \mathrm{~mm}$ long (total length), the stipitate base less than 0.1 mm long, the slender apical beak $0.1-0.2 \mathrm{~mm}$ long; achenial surfaces $0.2-0.3 \mathrm{~mm}$ wide, elliptic or narrowly ovate, planar.

Discussion. Distinguishing features of C. pseudovegetus are its round stems, usually hemispherical heads, broadly ovate spikelets, falcate scales, and long, narrow, stipitate achenes four to seven times longer than wide. The scales are $2-3 \mathrm{~mm}$ long, which is longer than in most of the related taxa, the exceptions being $C$. virens and $C$. intricatus. As in C. distinctus, the lateral sides of the scale are narrow, taper only slightly to the base, and do not overlap with others on the same side of the rachilla. Close examination of the scales and achenes will successfully differentiate C. pseudovegetus from those allies with which it may be sympatric, mainly $C$. virens, $C$. distinctus, and C. luzulae.

The two allopatric varieties of C. pseudovegetus are easily recognized. Variety pseudovegetus is limited to the eastern half of the United States and has smaller stems, fewer involucral bracts, and a more diminutive habit than variety megalanthus which is found from central Mexico south to Guatemala. Although the typical inflorescence in


Figure 11. A-D. Cyperus pseudovegetus var. pseudovegetus; A, inflorescence, $\times 1 / 2$ (based on Fisher 372); B-D (based on Demaree 3437); B, spikelet, $\times 5$; C, scale, $\times 17.5$; D, achene, $\times 17.5$. $\mathrm{E}-\mathrm{H}$. Cyperus pseudovegetus var. megalanthus (based on Lundell 2658); E, inflorescence, $\times 1 / 2 ; \mathrm{F}$, spikelet, $\times 5 ; \mathrm{G}$, scale, $\times 17.5 ; \mathrm{H}$, achene, $\times 17.5$. $\mathrm{I}-\mathrm{K}$. Cyperus distinctus (based on A. S. Hitchcock 385); I, spikelet, $\times 5$; J, scale, $\times 17.5$; K, achene, $\times 17.5$.
var. megalanthus shows the conversion of normal spikelets to a proliferation of leafy vegetative shoots indicating an abnormal reproductive system, some fruits are produced by the plants. The taxonomic delimitation of var. megalanthus is supported by its morphological distinction from related taxa, and at least partial sexual reproduction in widely separated localities.

Cyperus pseudovegetus Steudel var. pseudovegetus. Type: in Carolina australi, M. Curtis s.n. (K!, presumably an isotype). Figure 11 (A-D).

Cyperus arenicola Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.]: 51. 1854. Type: Texas, auf sandhugeln in der Colonie Rusk County, Aug. V, Vincent 26 (B!, presumably an isotype).

Cyperus cyrtolepis Torrey \& Hooker var. arenicola (Steudel) Böckeler, Linnaea 35: 558. 1868.

Cyperus luzulae Rottbфll var. umbellulatus Britton, Bull. Torrey Bot. Club 13: 208. 1886. Type: Delaware, Townsend, Aug 1874, Canby s.n. (NY!, lectotype); no locality specified, Lindheimer 201 ( K ! in part, paratype).

Cyperus calcaratus Nees ex S. Watson \& Coulter, in A. Gray Man. Bot. Northern U.S., ed. 6. 570. 1890. Type: Texas, of unknown origin (GH!, presumably a fragment of holotype).

Cyperus pseudovegetus Steudel var. arenicola (Steudel) Kukenthal, Pflanzenreich IV. 20 (Heft 101): 176. 1936.

Cyperus virens Michaux var. arenicola (Steudel) Shinners, Field \& Lab. 22: 30. 1954.
Plant up to $60(-80) \mathrm{cm}$ tall; leaves $3-8(12)$, (12-) $20-58 \mathrm{~cm}$ long; leaf sheath $2-12 \mathrm{~cm}$ long; leaf blade (1-) $4-6(-8) \mathrm{mm}$ wide at mid-length, usually conduplicate; involucral bracts (3-) $4-8$, up to 50 cm long, up to 5 mm wide; compound inflorescence $1.5-9 \mathrm{~cm}$ long; primary peduncles $3-10,0.5-5 \mathrm{~cm}$ long, $0.4-0.6 \mathrm{~mm}$ wide; secondary peduncles absent or $1-6$, up to 7 mm long and $0.3-0.5 \mathrm{~mm}$ wide; primary heads $7-15 \mathrm{~mm}$ long and $5-15 \mathrm{~mm}$ wide, with (15-) $35-80$ spikelets; secondary heads $5-11 \mathrm{~mm}$ long and $5-10 \mathrm{~mm}$ wide, with (12-) $20-60$ spikelets; spikelets $2-5 \mathrm{~mm}$ long, $1.5-3 \mathrm{~mm}$ wide, with (4-) 10-22 ( -26 ) scales; scale angles $20^{\circ}-30^{\circ}$ (or lowermost scales declined $45^{\circ}$ ); scales $1.5-2.2 \quad(-2.5) \mathrm{mm}$ long, $0.5-1 \mathrm{~mm}$ wide, apically acute to cuspidate and slightly excurved, the proximal abaxial groove between the two keels $0.8-1 \mathrm{~mm}$ long; sides of scale yellowish brown or reddish brown; stamen $1.8-2.5 \mathrm{~mm}$ long, the filament $1.5-2 \mathrm{~mm}$ long, the anther $0.5-0.8 \mathrm{~mm}$ long; style $0.8-1 \mathrm{~mm}$ long, the stigmatic branches $0.3-0.5 \mathrm{~mm}$ long; achene filling about three-fourths of the scale, bilaterally or radially symmetric, five to seven times longer than wide, $1-1.3(-1.5) \mathrm{mm}$ long (total length), the body $0.9-1.3 \mathrm{~mm}$ long; achenial surfaces equal in width.

Distribution. From New Jersey south to Florida, and west to Illinois, Oklahoma, and Texas. Habitats include sandy prairies, swampy thickets, marshes, chert bottoms, wet depressions in fields or floodplain forests, and drainage ditches with sandy loam soils, from sea level to 200 meters in elevation (Fig. 12).

Discussion. The four to eight involucral bracts and the achenes five to seven times longer than wide are the two characters that most readily separate this variety from var. megalanthus. The size and shape of the three achenial surfaces are similar to each other, but the whole achene may be curved slightly toward the adaxial surface, forming a bilaterally symmetric shape. The size and number of heads may vary, but the extent of this variation is of no apparent taxonomic significance.

When spikelets are infected with a smut, Testicularia cyperi, they become distorted. This condition was found on a specimen of var. pseudovegetus from Oklahoma (Mitchell 3815).

Representative specimens:
united states of america: new jersey: Salem co: Riddleton Station, Salem, 16 Sep 1894, Lippincott 128 (GH).


Figure 12. Distribution of Cyperus pseudovegetus var. pseudovegetus and C. pseudovegetus var. megalanthus.

DELAWARE: KENT CO: Harrington, Aug 1874, Canby s.n. (F, WTU). NEW CASTLE CO: Townsend, 4 Sep 1899, Canby s.n. (GH), July 1893, Canby s.n. (WTU); $21 / 2 \mathrm{mi}$ SW of Townsend, 18 July 1939, Tatnall 4289 (GH). SUSSEX CO: Ellendale, 15 July 1878, Canby s.n. (F), Aug 1878, Canby s.n. (MO); Georgetown, 18 Aug 1937, Smith 401 (C, CAS).

MARYLAND: DORCHESTER CO: Cambridge, 22 Aug 1873, Morong s.n. (F). MONTGOMERY CO: Great Falls, "flats" of Potomac River, 3 Oct 1938, Hermann 9883 (MICH, NY). ST. MARY'S CO: Scotland, 2 Sep 1923, Blake 8551 (LL). TALBOT CO: $3 / 4 \mathrm{mi}$ SSW of Unionville, 1 Sep 1947, Earle 4371 (GH). WICOMICO CO: Quantico, 8 mi SW of Salisbury, 30 Aug 1937, Smith 404 (UC).

WASHINGTON, D.C.: Potomac Flats, 30 Aug 1899, Pieters s.n. (MICH); wet places, 16 July 1896, Steele s.n. (GH).

VIRGINIA: ACCOMACK CO: $31 / 2 \mathrm{mi} \mathrm{N}$ of Accomac, 16 Oct 1935, Fernald et al. 5225 (GH). GREENSVILLE CO: swamps of Reedy River, 22 July 1881, Smith s.n. (GH). HALIFAX CO: Lawson Creek, J.E.B. Stuart Highway, SW of South Boston, 21 June 1938, Fosberg 15408 (GH). HENRICO CO: West Hampton, 17 June 1922, Randolph \& Merriman 272 (GH). ISLE OF WIGHT CO: near Fort Eustis, 30 Aug 1941, Bright 18385 (UC). JAMES CITY CO: about 2 mi W of Five Forks, 1 Aug 1939, Menzel 246 (GH). MATHEWS CO: Mob Jack Bay, 7 Aug 1875, Leggett s.n. (UC). NANSEMOND CO: Suffolk, 13 July 1895, Blankinship s.n. (GH). NORFOLK CO: vicinity of Norfolk, 3 July 1892, Britton et al. s.n. (F). PRINCESS ANNE CO: near Virginia Beach, 12 July 1893, Heller 1065 (DS, GH). ROANOKE CO: at base of Fort Lewis Mt. about 1.8 mi from Salem P. O., 21 Aug 1942, Wood 5094 (GH). SUFFOLK CO: no locality, 24 July 1872, Curtiss s.n. (GH). SUSSEX CO: Waverly, 20 July 1891, Seymour s.n. (GH). YORK CO: Portsmouth, no date, Noyes s.n. (GH); 2 mi S of Yorktown, 13 Sep 1935, Fernald et al. 4807 (GH, NY).

NORTH CAROLINA: BEAUFORT CO: near Belhaven, 25 June 1935, Correll 1684 (DUKE). CARTERET CO: 1 mi E of Beaufort, 7 July 1938, Blomquist 10340 (DUKE). COLUMBUS CO: near Bolton, 17 July 1926, Heller 14127 (DS, MO, NY); 3 mi E of Hallsboro, 8 July 1927, Wiegand \& Manning 504 (GH); 4 mi E of Bolton, 5 July 1927, Wiegand \& Manning 503 (GH). CUMBERLAND CO: $11 / 2 \mathrm{mi}$ NE of Godwin, 14 Oct 1951, Fox \& Boyce 5640 (DUKE, GH, MICH); $1 / 2 \mathrm{mi}$ SE of Rockfish Creek, along N.C. rt. 87 S of Fayetteville, 26 June 1949, Godfrey \& Fox 49361 (DUKE, TEX). CURRITUCK CO: Knotts Island, 4 July 1935, Correll 2194 (DUKE). DAVIDSON CO: 2.6 mi S of Southmont, 28 Sep 1968, Leonard 2095 (B); Yadkin River near High Rock, 16 June 1956, Radford 12949 (LL). DUPLIN CO: 1.5 mi SE of Faison on US 117, 15 June 1957, Ahles \& Haesloop 28455 (UC). DURHAM CO: Duke Forest, 1 Sep 1932, Blomquist 750 (DUKE); W. Durham, 24 July 1931, Blomquist 5533 (DUKE). FRANKLIN CO: 4.4 mi W of

Sutton, 3 Nov 1934, Oosting 34797 (DUKE). GATES CO: near Gatesville, 18 July 1938, Godfrey 5252 (GH); near Sunburg, $7 / 5 / 35$, Correll 2234 (DUKE). GREENE CO: near Snow Hill, 21 June 1935, Correll 1354 (DUKE); near Farmville, 8 June 1938, Godfrey 4317 (DUKE, GH). GUILFORD CO: Greensboro, 5 Oct 1960, Wagner 603 (DUKE). HALIFAX CO: near Scotland Neck, 7 July 1935, Correll 2378 (DUKE). HERTFORD CO: Camp Co. Forest, E of Como, 23 July 1949, Godfrey \& Fox 49669 (DUKE, GH). JOHNSTON CO: about 4 mi W of Princeton, 5 Aug 1946, Wood, Jr. 6525 (GH, WTU). LEE CO: 2 mi S of Lemon Springs, 14 July 1966, Pence 44966 (GH). NASH CO: near Rocky Mount, 7/8/35, Correll 2479 (DUKE); 1 mi E of Middlesex, 5 July 1949, Blomquist 14681 (DUKE); near Nashville, 18 July 1938, Godfrey 5147 (DUKE, GH); 5 mi N of Rocky Mount, 22 July 1949, Godfrey \& Fox 49636 (DUKE); 1 mi E of Rocky Mount, 15 June 1955, Blomquist \& Ebert 16707 (DUKE); NEW HANOVER CO: Wilmington, 1884, McCarthy s.n. (TEX). NORTHAMPTON CO: N of Roanoke River bridge, US Rte 258, 9 June 1949, Godfrey \& Fox 49219 (DUKE, UC). ONSLOW CO: 9 mi E of Jacksonville, 2 July 1949, Blomquist 14633 (DUKE). ORANGE CO: no locality, 12 Aug 1932, Blomquist 5534 (DUKE). PERQUIMANS CO: $41 / 2 \mathrm{mi} \mathrm{S}$ of Hertford, 5 Aug 1950, Fox 4175 (DUKE); 4 mi N of Winfall, 18 June 1927, Wiegand \& Manning 500 (GH). PITT CO: 2 mi E of Grimesland, 24 June 1927, Wiegand \& Manning 502 (GH); 1 mi E of Bethel, 11 June 1952, Cappel \& Godfrey 107 (UC). ROWAN CO: vicinity of Salisbury, 3 July 1890, Heller 184 (UC). STANLEY CO: banks of Little Long Creek, Albemarle, 17 Aug 1892, Small 391613 (F). UNION CO: 3 mi SSE of Waxhaw, 14 July 1957, Ahles \& Haesloop 31402 (GH). WAKE CO: 3.4 mi S of junction US 1 and NC 55 in Apex on NC 55,27 Aug 1961, Ahles \& Williamson 54944 (DS). WASHINGTON CO: 4 mi E of Plymouth, 20 June 1927, Wiegand \& Manning 501 (GH). WILSON CO: 1 mi SE of Stantonburg, 8 July 1922, Randolph \& Randolph 704 (GH).

SOUTH CAROLINA: AIKEN CO: Aiken, Aug 1870, Ravenel s.n. (MICH). BARNWELL CO: no locality, 4 June 1952, Batson \& Kelley s.n. (UC). BERKELEY CO: Santee River, 3 mi NE of Pineville, 14 July 1939, Godfrey \& Tryon 658 (CAS, GH, MO, UC). CHARLESTON CO: Adams Run, 15 Aug 1939, Godfrey \& Tryon 1545 (GH, NY). DORCHESTER CO: no locality, 16 June 1936, Correll 5357 (GH). GEORGETOWN CO: 12 mi NW of Georgetown, 21 July 1939, Godfrey \& Tryon 754 (BM, CAS, DS, GH, MICH, UC). JASPER CO. 6.1 mi SW of Ridgeland on US Hwy 17, 26 June 1956, Bell 3710 (TEX). LEXINGTON CO: Batesburg, 15 June 1913, McGregor 182 (DS). MARLBORO CO: 9 mi SW of Bennettsville, 10 Aug 1956, Radford 15466 (C). SUMTER CO: no locality, no date, Ravenel s.n. (GH). WILLIAMSBURG CO: 2 mi NE of Lane, 10 July 1939, Godfrey \& Tryon 408 (CAS, MO, NY, UC); 1 mi SW of Lane, 10 July 1939, Godfrey \& Tryon 414 (GH).

GEORGIA: BAKER CO: 3 mi NE of Field Station, 21 Aug 1947, Thorne 6194 (F, MO). BROOKS CO: just N of Quitman, 20 Sep 1940, Duncan 2982 (MO). DECATUR CO: near Fourmile Creek, 4 mi S of Bainbridge, 12 July 1947, Thorne 4618 (GH). DE KALB CO: near Stone Mountain, 20 May 1933, Miller et al. 452 (MO). DOUGHERTY CO: near Albany, 22 June 1901, Curtiss 6816 (GH, MO, UC). FLOYD CO: Rome, July 1888, McCarthy 218 (DS). MCDUFFIE CO: vicinity of Thomson, 16 Aug 1907, Bartlett 1011 (MICH). MCINTOSH CO: W side of Sapelo Island, W of S tip of Blackbeard Island, 20 Sep 1956, Duncan 20578 (TEX). MILLER CO: ca 1 mi N of Donaldsonville, 26 Oct 1963, Godfrey 63200 (TEX). RICHMOND CO: about Augusta, 27 June-1 July 1895, Small s.n. (F); 4.5 mi S of Augusta, 5 July 1940, Radford 580 (TEX, UC). WHITFIELD CO: Mill Creek bottoms, 23 July 1900, Harper 301 (GH, $\mathrm{K}, \mathrm{MO}$ ).

FLORIDA: BROWARD CO: W of Deerfield, 28 July 1949, Jackson s.n. (LL). CALHOUN CO: no locality, no date, Chapman s.n. (MO). GADSDEN CO: wooded bank of Chattahoochee, 13 July 1897, Curtiss 6028 (GH). JACKSON CO: marshy border of Lake Seminole, about 3 miN of Sneads, 12 Aug 1964, Henderson 64-427 (MO). LEON CO: no locality, 10 June 1955, Godfrey 53497 (GH, NY). MADISON CO: no locality, June-July 1898, Hitchcock s.n. (MO). MARION CO: no locality, June-July 1898, Hitchcock 2106(F).

INDIANA: JEFFERSON CO: near Chelsea, SW of Hanover, 19 Aug 1935, Banta 56676 (GH). KNOX CO: about $4 / 5 \mathrm{mi}$ NE of Oaktown, 8 Oct 1938, Kriebel 7078 (DUKE). POSEY CO: about 3 mi W of Hovey or Bill Nye, about 7 mi SW of Mt. Vernon, 19 Aug 1922, Deam 37685 (GH, NY).

KENTUCKY: CALLOWAY CO: between Murray and New Concord, 20 July 1937, Smith \& Hodgdon 4080 (GH). CLINTON CO: slough NW of Albany, 18 July 1937, Smith \& Hodgdon 4027 (GH).

TENNESSEE: CARROLL CO: no locality, 27 Aug 1922, Svenson 431 (GH). COFFEE CO: Tullahoma, 15 July 1938, Svenson 9408 (GH); Dry Oak Barrens, Tullahoma, 24 Aug 1930, Svenson 4259 (GH). DAVIDSON CO: Nashville, no date, Gattinger s.n. (UC). FRANKLIN CO: marsh at Decherd, Aug 1898, Ruth 120 (MO). MADISON CO: 7 mi NW of Jackson, 15 July 1939, Hubricht B1626 (UC). MCNA IRY CO: no locality, 1 July 1893, Bain 483 (GH).
alabama: CULLMAN CO: Cullman, 16 Aug 1886, Mohr s.n. (DS). DE KALB CO: P. O.

Fort Payne, 22 June 1964, Demaree 50473 (NO). ETOWAH CO: nr. Attalla, 30 June 1895, Eggert s.n. (MO). HALE CO: 5 mi S of Sawyerville, 30 June 1966, Maginness 301 (GH). JEFFERSON CO: Birmingham, Aug 1888, McCarthy s.n. (UC). LEE CO: Auburn, 7/3/97, Earle \& Baker s.n. (MO). LIMESTONE CO: Wheeler Reservoir, 8/4/46, Isely 4890 (B). MOBILE CO: no locality, Apr, Mohr s.n. (MICH)

ILLINOIS: JEFFERSON CO: ponds near Opdyke, 13 Aug 1898, Eggert s.n. (MO). MASSAC CO: Metropolis, 15 Aug 1902, Gleason 2242 (GH). ST. CLAIR CO: Queens Lake, 1 Aug 1891, Eggert s.n. (BM, MO).

MISSISSIPPI: FÓRREST CO: 10 mi SE of Hattiesburg, 5 July 1958, Kral \& Kral 7124 (GH). HANCOCK CO: no locality, 17 Nov 1938, Penfound s.n. (NO). LAFAYETTE CO: 4 mi SW of Taylor, 11 Aug 1958, McDaniel 1004 (MO). MONROE CO: Amory, 21 Sep 1891, Seymour s.n. (DUKE).

MISSOURI: BARTON CO: 8 mi N of Iantha, 19 July 1955, Palmer 60808 (F); $31 / 2 \mathrm{mi}$ SE of Verdella, 19 July 1955, Palmer 60782 (F). BATES CO: about 4 mi N of Butler, 21 July 1965, Henderson 65-582 (MO); 3 mi NW of Quinn, 30 Sep 1955, Palmer 61459 (F). BUTLER CO: Neeleyville, 2 Oct 1892, Dewart s.n. (MO). CAPE GIRARDEAU CO: 3 mi W of Arbor, 22 Sep 1946, Steyermark 64145 (BM). DADE CO: 3 mi SW of Everton, 23 June 1941, Steyermark 40225 (GH). DUNKLIN CO: Campbell, 9 Sep 1910, Bush 6281 (GH). HOWELL CO: $7 \frac{1}{2} \mathrm{mi}$ SW of West Plains, 24 July 1949, Steyermark 68591 (F). JASPER CO: 2 mi SE of Webb City, 10 Aug 1949, Palmer 29723 (F); near Webb City, 20 Aug 1927, Palmer 32604 (GH). MCDONALD CO: no locality, 24 July 1892, Bush s.n. (BM, MO). MISSISSIPPI CO: 4 mi W of Charleston, 11 July 1933, Palmer \& Steyermark 41475 (BM). NEW MADRID CO: 2 mi S of Lilbourn, 4 July 1952, Steyermark 73647 (F). NEWTON CO: about 2 mi S of Neosho, 7 July 1967, Henderson 67-1141 (CAS); Joplin Chert Barrens, 13 July 1927, Kellogg 1479 (MO, UC). PHELPS CO: 10 mi SE of Rolla, 2 mi SW of Elk Prairie, 18 Aug 1951, Steyermark 72479 (F), 22 Sep 1950, Steyermark 70897 (F). RIPLEY CO: $41 / 2 \mathrm{mi} \mathrm{S}$ of Naylor, 28 May 1951, Steyermark 71265 (F). VERNON CO: 3 mi NW of Milo, 16 July 1950, Steyermark 69969 (F). WEBSTER CO: 2 mi NW of Niangua, 3 Sep 1951, Steyermark 72629 (BM, F).

ARKANSAS: BRADLEY CO: Warren, 13 June 1944, Demaree 25035 (GH). CALHOUN CO: Thornton, 7-4-42, Demaree 23365 (NO,UC). CHICOT CO: Lake Village, 28 June 1942, Demaree 23254 (GH, TEX). CLARK CO: Arkadelphia, 25 June 1938, Demaree 17825 (DS). CLAY CO: near St. Francis River, 3 July 1948, Demaree 26977 (TEX). CLEVELAND CO: P. O. Kingsland, 28 June 1942, Demaree 23323 (L). CRAIGHEAD CO: no locality, 6 June 1948, Demaree 26651 (TEX); Black Oak, 14 June 1927, Demaree 3360 (BM, CAS); NE Ark., Lake City, 27 June 1927, Demaree 3437 (MICH). CRITTENDEN CO: Hulbert, 7 June 1937, Demaree 15182 (UC). DREW CO: P. O. Wilmar, 3 July 1943, Demaree 24520 (GH). GREENE CO: Walcott, 30 June 1949, Demaree 27936 (GH, NO). HEMPSTEAD CO: Fulton, 5 Oct 1923, Greenman 4431 (BM), 17 June 1915, Palmer 8026 (CAS). HOWARD CO: Mineral Springs, 10 July 1960, Demaree 42735 (GH). LAWRENCE CO: P. O. Strawberry, 12 July 1947, Demaree 26206 (GH). MILLER CO: P. O. Texarkana, 30 June 1943, Demaree 24506 (GH). MONROE CO: Brinkley, 4 Aug 1955, Demaree 37791 (GH). POINSETT CO: Waldenburg, 13 June 1950, Demaree 29071 (GH, NO). PRAIRIE CO: P. O. De Valls Bluff, 15 June 1941, Demaree 22193 (B). PULASKI CO: Little Rock, 9 Aug 1939, Demaree 19787 (BM, UC); Little Rock, 22 May 1938, Demaree 17513 (UC). ST. FRANCIS CO: margin of Shell Lake, 8 June 1937, Demaree 15105 (B, UC). UNION CO: P. O. Strong, 25 June 1939, Demaree 19400 (B).

LOUISIANA: CALCASIEU PARISH: vicinity of Lake Charles, 25 Aug-10 Sep 1898, Mackenzie 432 (MO); vicinity of Lake Charles, 28 May 1904, Allison 256 (GH). CAMERON PARISH: Lacassine Refuge, 27 Apr 1963, Eggler s.n. (NO). LINCOLN PARISH: Ruston, Woodland Park, 21 Sep 1970, McNabb 95 (F). ORLEANS PARISH: New Orleans, no date, Bomhard 308 (NO). OUACHITA PARISH: near Brownsville, S of Monroe, 14 June 1957, Ewan 19182 (NO). PLAQUEMINES PARISH: Pointe à la Hache, near Woodinville, 17 Sep 1892, Langlois s.n. (MICH). RAPIDES PARISH: vicinity of Alexandria, 8 June 1899, Ball 594 (F, GH, MO). RICHLAND PARISH: Archibald, 4 July 1958, Kral \& Kral 7093 (GH). SABINE PARISH: no locality, 27 June 1963, Demaree 48125 (UC). ST. MARTIN PARISH: 1 mi SW of Breaux Bridge, 10 July 1938, Correll \& Correll 9449 ( GH ). ST. TAMMANY PARISH: Fontainebleau State Park, Mandeville, 11 June 1966, Thieret 23402 (TEX). TANGIPAHOA PARISH: S edge of Hammond, 2 July 1938, Correll \& Correll 9325 (GH). WASHINGTON PARISH: along Bogue Chitto River, 1.5 mi S of Enon, 12 June 1966, Thieret 23466 (TEX).

KANSAS: CRAWFORD CO: 6 mi SE of Pittsburg, 21 June 1929, Rydberg \& Imler 177 (NY).

OKLAHOMA: ATOKA CO: Atoka Lake at Stringtown, 16 July 1970, Correll \& Correll 39172 (LL). COMANCHE CO: no locality, 25 June 1913, Stevens 1332 $1 / 2$ (DS). LE FLORE CO: 2 mi S of Talihina on hwy. 271, 18 Aug 1967, Mitchell 3833 (LL). LOVE CO: 5 mi SE of Ardmore in Lake Murray State Park, 17 July 1967, Crutchfield 3447 (LL). MAYES CO: about $1 / 4 \mathrm{mi} \mathrm{N}$ of
junction of hwy. 28, 21 Aug 1965, Correll \& Correll 31443 (LL). MCCURTAIN CO: Smithville, 17 Sep 1970, Correll \& Correll 39752 (LL); 10 mi E of Haworth, 23 June 1948, Waterfall 8041 (DS). MUSKOGEE CO: Haskell Lake, 3 mi NW of Haskell, 13 Aug 1967, Mitchell 3730 (LL). OSAGE CO: 4 mi N of Hula near the Kansas border, 8 Aug 1967, Mitchell 3581-A (LL). OTTAWA CO: near Hatterville, 30 Aug 1913, Stevens 2471 (DS, GH). PITTSBURGH CO: Arrowhead State Park, 23 Sep 1970, Correll \& Correll 39943 (LL). PUSHMATAHA CO: 3 mi N of Rattan, 24 Sep 1970, Correll \& Correll 39977 (LL). SEQUOYAH CO: 8 mi N of Sallisaw on hwy. 59, 16 Aug 1967, Mitchell 3797 (LL).

TEXAS: ANDERSON CO: Long Lake, Trinity Valley, 9 June 1899, Eggert s.n. (MO); Palestine, 7 June 1920, Tharp 42 (UC). AUSTIN CO: Austin, 1892, Wurzlow s.n. (DS). BASTROP CO: no locality, 15 July 1924, Duval 29 (TEX). BOWIE CO: about 6.5 mi N of Texarkana, 13 Aug 1966, Correll 33389 (LL). BRAZOS CO: in marsh, 15 Nov 1941, Weaver 318 (MICH). CALHOUN CO: Port O'Connor, 19 May 1930, Tharp s.n. (TEX). CASS CO: Atlanta, 17 June 1926, McClung 9199 (TEX). CHAMBERS CO: Anahuac, 22 July 1929, Tharp s.n. (TEX). DALLAS CO: Trinity River Bottoms, 20 June 1945, Lundell 13908 (LL). GALVESTON CO: no locality, 27 June 1942, Nelson s.n. (TEX). GREGG CO: 7 mi S of Longview, 16 July 1967, Mitchell 3198 (LL). HARRISON CO: Marshall, 17 May 1974, Fleetwood 10961 (LL). HARRIS CO: Houston, 20 July 1919, Fisher s.n. (L), 10 June 1937, Fisher 372 (C, CAS, DS, MICH, NY), 37232 (DS, DUKE). HARRIS CO: N of Houston, 28 mi from Conroe, 19 July 1944, Lundell 13095 (LL, TEX). HENDERSON CO: Cade Lake, 10 May 1940, Siegel 164 (TEX). HOUSTON CO: 3 mi N of Crockett, 10 June 1970, Correll \& Correll 38946 (LL). HUNT CO: 4 mi S of Commerce, 16 July 1968, Correll \& Correll 35896 (LL). JACKSON CO: La Ward, 24 July 1951, Tharp et al. 51-1640 (TEX). JEFFERSON CO: Beaumont, 22 June 1917, Johnston s.n. (UC). KAUFMAN CO: SE side of Terrell City Lake, $21 / 4 \mathrm{mi} \mathrm{E}$ of Terrell, 7 Sep 1945, Cory 49700 (LL). LAMAR CO: about 5 mi NE of Paris, 22 July 1969, Correll 37519 (LL). LAVACA CO: about 18 mi SE of Yoakum, 16 July 1949, Tharp et al. 49159 (TEX). MARION CO: edge of small pond adjacent to Caddo Lake at Big Lake Camp, E \& N of Leigh, 17 July 1967, Mitchell 3233 (LL). MATAGORDA CO: Tres Palacios, 20 June 1923, Tharp 2112 (TEX). MCLENNAN CO: Gaphead, no date, Smith 862 (TEX). MORRIS CO: 1 mi W of Naples, 20 July 1969, Correll 37473 (LL). NACOGDOCHES CO: Attoyac River just N of the Rayburn Reservoir on hwy. 103, 26 Aug 1967, Mitchell 3990 (LL). PANOLA CO: 6.5 mi S of Carthage, 29 July 1956, Shinners 24267 (NO). TYLER CO: N of Colmesneil and 2 mi S of Neches River, 10 Aug 1968, Correll \& Correll 36031 (LL). WALKER CO: near Huntsville, July 1913, Young s.n. (TEX). WALLER CO: Hempstead, 20 Apr 1872, Hall 680 (F). WOOD CO: E of Mineola, 26 June 1945, Lundell 13952 (LL); Mineola, 14 Aug 1900, Reverchon 2296 (MO).

Cyperus pseudovegetus Steudel var. megalanthus Kükenthal, Pflanzenreich IV. 20 (Heft 101): 176. 1936. Type: Mexico, San Luis Potosí, banks of streams, Las Canoas, 17 June 1891, Pringle 3716 (B!, lectotype; CAS!, ENCB!, F!, GH!, M!, MICH!, MSC!, NY!, TEX!, UC!, US!, isolectotypes). Figure $11(\mathrm{E}-\mathrm{H})$.

Plant $30-55 \mathrm{~cm}$ tall; leaves $4-7,17-70 \mathrm{~cm}$ long; leaf sheath $3-14 \mathrm{~cm}$ long; leaf blade $4.5-8 \mathrm{~mm}$ wide at mid-length, usually flat; involucral bracts (5-) $8-18$ ( -40 ), $6-42 \mathrm{~cm}$ long, $2-6(-9) \mathrm{mm}$ wide; compound inflorescence $2-5 \mathrm{~cm}$ long, often viviparous; primary peduncles absent or $3-7,1-3.5 \mathrm{~cm}$ long and $0.8-1.2 \mathrm{~mm}$ wide; secondary peduncles absent or $1-3$, up to 1 cm long, ca 0.4 mm wide; primary heads (6-) $10-18 \mathrm{~mm}$ wide and with $60-100$ spikelets; secondary heads ca 7 mm wide and with ca 40 spikelets; spikelets $3.5-5 \mathrm{~mm}$ long, $3-4 \mathrm{~mm}$ wide, with $8-18$ scales; scale angles $40^{\circ}-45^{\circ}\left(-60^{\circ}\right)$; scales $2-2.5 \mathrm{~mm}$ long, $0.7-1 \mathrm{~mm}$ wide, apically acute and excurved, the proximal abaxial groove between the two keels $1.2-1.5 \mathrm{~mm}$ long; sides of scale stramineous or light brown; stamen $2-2.8 \mathrm{~mm}$ long, the filament ca 2 mm long, the anther $0.7-1.0 \mathrm{~mm}$ long; style ca 1.3 mm long, the stigmatic branches ca 1 mm long; achene filling one-half to three-fifths of the scale, radially or bilaterally symmetric, four (to six) times longer than wide, $1.2-1.3 \mathrm{~mm}$ long (total length), the body ca 1 mm long; achenial surfaces equal or unequal in width, sometimes the adaxial surface 0.1 mm wider than the two abaxial ones.

Distribution. Mexico, from San Luis Potosí southeast to Veracruz and Yucatán, and Guatemala, from Alta Verapaz to Petén. In moist, loamy soil along streams or rivers at elevations of 75 to 350 meters (Fig. 12).

Discussion. Of immediate distinction, the number of involucral bracts ranges from five to forty, surpassing that of any of the related taxa. Correlated with the unusually large number of bracts is the typical condition of several leafy vegetative shoots in the inflorescences. The achenes are generally radially symmetric, but may be bilaterally symmetric when the adaxial surface is slightly wider (by ca 0.1 mm ) than the two abaxial surfaces. The achenes are straight, rather than curved toward the adaxial surface as in var. pseudovegetus.

Variety megalanthus tends to combine morphological features of var. pseudovegetus and C. luzulae. The scales and achenes are most similar to those of var. pseudovegetus, but some of the foliage characters resemble those of $C$. luzulae. Could var. megalanthus have arisen via hybridization between these two taxa? The abnormal condition of leafy vegetative shoots in the inflorescences, and the intermediate morphological profile tend to support a hybrid origin for the taxon, but further evidence, particularly cytological and crossing data, are needed to justify more positive conclusions.

Representative specimens:
MEXICO: SAN LUIS POTOSI: along the gravel road to Jalpan ca 12 mi NE of Xilitla, 29 Mar 1961, King 4382 (F, MICH, TEX, UC). VERACRUZ: Sanborn, 28 Feb 1910, Orcutt 3243 (BM, MICH, US). QUINTANA ROO: El Paso, 28 Apr 1932, Lundell 1606 (DS, MICH, US).

GUATEMALA: ALTA VERAPAZ: no locality, May 1904, Turckheim II 975 (UC, US). PETEN: Petén, 12 Apr 1933, Lundell 2658 (CAS, MICH, US); Cerro Ceibal (Sierra Mojada, Cerro San Martín), 30 Apr 1942, Steyermark 46130 (MICH, UC). VERAPAZ: near the Finca Sepacuite, 4 Apr 1902, Cook \& Griggs 437 (UC); Cubilguitz, M May 1904, Turckheim 8777 (US).

Cyperus reflexus Vahl, Enum. Pl. 2: 299. 1806.
Rhizomatous (less commonly tufted) perennial up to 80 cm tall; stems erect, round or roundly triquetrous, smooth, grayish green, green, or stramineous, $0.5-1.2 \mathrm{~mm}$ wide distally, $1-2.5 \mathrm{~mm}$ wide at the base; leaves $3-8$, about one-half as long as the stem, up to 40 cm long; leaf sheath mostly red, or light to dark reddish-brown, with inconspicuous transverse septa between the veins, seldom nodulose, often persistent and becoming brown and fibrous; leaf blade $2-2.5 \mathrm{~mm}$ wide at mid-length, often conduplicate, occasionally flat, grayish green, light green, or stramineous, attenuate at apex; involucral bracts with the lowermost and longest one usually wiry, stiff, $\pm$ erect, elongate, and appearing like a prolongation of the stem (sometimes reflexed by a large sessile head), sheathless or with a sheath less than 1.5 mm long, often conduplicate, sometimes flat, grayish green, light green, or stramineous, with rare and inconspicuous transverse septa between the veins, rarely nodulose, apically attenuate; compound inflorescence $1.5-8 \mathrm{~cm}$ long; primary peduncles round, smooth, mostly erect and stiff; secondary peduncles straight; heads globose or hemispherical; bracteoles ovate, $2-3 \mathrm{~mm}$ long, $5-10$-veined, membranous or crustaceous, apically acute; rachilla $0.15-0.25 \mathrm{~mm}$ wide, $0.05(-0.1) \mathrm{mm}$ thick, straight or slightly arched, stramineous with reddish-glandular, longitudinal striations; scale angles ca $45^{\circ}$; scales (0.8-) $1.5-1.8(-2.2) \mathrm{mm}$ long, $0.8-1.5 \mathrm{~mm}$ wide, or ca 0.5 mm wide and usually triangular in lateral view, adaxially light red, weakly bicarinate basally, apically acute or mucronate and straight (or subtly excurved), the proximal abaxial groove between the two keels 0.4 mm long; medial part of scale firmly membranous, stramineous or yellowish green, seldom scabrellate distally; sides of scale crustaceous, reticulate with conspicuous cells when immature, becoming smooth and glossy when mature, the margins often hyaline and revolute on the upper two-thirds to three-fourths of the scale, basally attached to the rachilla for $0.2-0.3 \mathrm{~mm}$; stamen solitary, $2-2.5 \mathrm{~mm}$ long, the filament $1.5-2 \mathrm{~mm}$ long, the anther $0.8-1.1 \mathrm{~mm}$ long; pollen $25-30 \mu$ in diameter; style $0.8-1 \mathrm{~mm}$ long, the stigmatic branches $0.4-0.6 \mathrm{~mm}$ long; achene radially
symmetric, trigonous, $0.9-1.4 \mathrm{~mm}$ long (total length), the stipitate base less than 0.1 mm long, rarely broadened, and the slender apical beak ca 0.1 mm long; achenial surfaces of equal width, $0.3-0.4 \mathrm{~mm}$ wide.

Discussion. Although most taxa in the Luzulae group appear tufted or may have abbreviated rhizomatous structures, the ability to produce elongated, scaly rhizomes is evident only in C. reflexus. The distinctive features of this species besides its rhizomatous habit include reddish leaf sheaths, slender stems, and lustrous scales. The lowermost involucral bract appears to be a continuation of the stem, being somewhat stiff, erect, and slender. The involucral bracts are markedly unequal in length and usually number between two and four.

The degree of taxonomic variation is greater in variety reflexus than in variety fraternus. The two taxa tend to merge with each other to such a degree that I think the recognition of varieties, rather than species, more accurately depicts their interrelationships. Specimens have been collected, particularly in South America, that tend to be morphologically transitional between the two varieties with respect to achene features; these collections are here referred to variety reflexus. Both varieties are found in the southern United States, Mexico, and South America; no records are available for either taxon in the Central American countries. Particularly indistinguishable vegetatively, the two varieties are modally distinct in the color of their scales and in the shape of their achenes.

Cyperus reflexus Vahl var. reflexus. Type: USA, Texas, no locality specified, Drummond 1 (NY!, isotype). Figure 13 (E-H).

Cyperus sellowii Link, Hort. Bot. Berol. 1: 307. 1827. Type: Uruguay, Montevideo, Sello s.n. (B!, holotype).

Cyperus rufescens Torrey \& Hooker, Ann. Lyceum Nat. Hist. New York 3: 436. 1836. Type: USA, Texas, Rio Brazos, Drummond s.n. (NY!, lectotype; B!, K!, PH! in part, isolectotypes).

Cyperus haemostachys Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.]: 41. 1854. Type: Chile, in insula Valenzuela et pr. u. Valdivia, Nov. m. 1850, Lechler 283 (B!, presumably an isotype).

Cyperus baazas Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.]: 316. 1855. Type: Texas, Rio Brazos, Drummond s.n. (B!, presumably an isotype).

Cyperus reflexus Vahl var. macrostachys Böckeler, Linnaea 35: 559. 1868. Type: Brasil, Sello s.n. (B!, holotype).

Cyperus reflexus Vahl var. genuina forma capitata Osten, Anales Mus. Nac. Montevideo, II. 3: 136. 1931, Type: Uruguay, not cited in description; not found, but description fits var. reflexus; var. genuina as published refers to var. reflexus.

Leaf sheath $2-7(-12) \mathrm{cm}$ long; involucral bracts $3-4(-5)$, up to 15 cm long and up to 2.5 mm wide; compound inflorescence (excluding leafy bracts) $1.5-5 \mathrm{~cm}$ long; primary peduncles absent or $3-6(-8)$, up to 4 cm long, $0.5-1 \mathrm{~mm}$ wide; secondary peduncles usually absent or $1-2$, up to 1 cm long and ca 0.5 mm wide; primary heads $10-15 \mathrm{~mm}$ wide, with (25-) $50-100$ spikelets; secondary heads $8-12 \mathrm{~mm}$ wide, with (25-) $40-60$ spikelets; bracteoles $2-2.5 \mathrm{~mm}$ long, 5 -veined; spikelets (2.5-) $4-10(-22) \mathrm{mm}$ long, $0.8-1.5(-2.8) \mathrm{mm}$ wide, with (6-) $12-24$ scales; rachilla with transverse scale scars $0.5-0.6 \mathrm{~mm}$ apart on each side; sides of scale dark red or sometimes stramineous distally; achene filling two-fifths to three-fifths of the scale, brown or black, broadly trigonous, acutely angled, two and one-half times longer than wide, $0.9-1.1 \mathrm{~mm}$ long (total length), the body $0.8-1 \mathrm{~mm}$ long; achenial surfaces 0.4 mm wide, usually obovate (less frequently elliptic), slightly concave or sometimes planar.

Distribution. In the United States known only from Texas; in Mexico from Guanajuato, Jalisco, and México; disjunct to South America, where it occurs in Bolivia, Brazil, Argentina, Chile, and Uruguay. Found in moist sandy depressions, sandy clay grasslands, low floodable ground, open woodlands, rock crevices along streams or rivers, from sea level to 2200 meters in elevation (Fig. 14).


Figure 13. A-D. Cyperus surinamensis (based on Rzedowski \& McVaugh 728); A, habit, $\times 1 / 2$; B, spikelet, $\times 5$; C, scale, $\times 15$; D, achene, $\times 15$. E-H. Cyperus reflexus var. reflexus (based on McVaugh 12780); E, inflorescence, $\times 1 / 2$; F, spikelet, $\times 5$; G, scale, $\times 15$; H, achene, $\times 15$. I-K. Cyperus reflexus var. fraternus (based on Pringle 11724); I, spikelet, $\times 5$; J, scale, $\times 15$; K, achene, $\times$ 15. L-O. Cyperus luzulae (based on Diaz Luna 426); L, inflorescence, $\times 1 / 2$; M, spikelet, $\times 5$; N, scale, $\times 15$; O, achene, $\times 15$.

Discussion. Characters of the achenes and scales are the most reliable for distinguishing this taxon. The achenes are broadly trigonous and two to two and one-half times longer than wide and have obovate (infrequently elliptic) and concave surfaces. The scales typically have deep red or reddish brown sides and a stramineous to yellowish green medial portion. This pattern may vary in South American specimens where the scales may be completely red or where the medial portion may be yellowish


Figure 14. Distribution of Cyperus reflexus var. reflexus, C. reflexus var. fraternus, and C. surinamensis.
green or stramineous either proximally or distally while the rest is red. In some populations from Argentina, the scales formed on plants subjected to frequent flooding are about two-thirds the average size for this variety. The smaller scales are distinctive but do not justify the recognition of a new taxon.

Variation of the compound inflorescence may be notable but without taxonomic significance, as in the development of the primary and secondary peduncles. In certain South American specimens, a single large head of spikelets may terminate the stem when the peduncles fail to develop. Normally, primary peduncles are evident and may number as many as eight. Secondary peduncles and their corresponding heads have been observed only in a few North American collections. A distortion of the heads occurs when the spikelets are infected with a smut, Testicularia cyperi (noted on Hall 679).

Taxonomic relationships of this variable and widely distributed taxon are difficult to assess. In Texas, C. acuminatus and C. pseudovegetus have reddish spikelets and leaf bases and tend to resemble var. reflexus. There may be hybridization among all these taxa, but the hybrids have not been clearly identified. Hybridization involving var. reflexus is indicated by the presence of aborted achenes on several collections. These sterile plants exhibit features characteristic of var. reflexus: prominently red scales, short scaly rhizomes, and obovate achenial surfaces.

Representative specimens:
UNITED STATES OF AMERICA: TEXAS: BRAZORIA CO: Brazoria Wildlife Refuge, Salt Cedars, 10 July 1968, Fleetwood 9278 (LL). BRAZOS CO: W of College Station, 8 June 1965, Massey 961 (LL). HARRIS CO: Houston, 25 Apr 1961, Traverse 2041 (A, TEX). DEWITT CO: near Hochheim, May 1961, Johnston 6222a (TEX). NUECES CO: Corpus Christi, May 1913, Orcutt 5816 (BM).

MEXICO: GUANAJUATO: no locality, 1902, Dugès 17 (GH). JALISCO: along highway 2 mi S of Ojuelos de Jalisco, 6 Sep 1956, McVaugh 12780 (MICH, US). ESTADO DE MEXICO: San Felipe, Mpio. de Cuautitlán, 4 Apr 1966, Mitastein 107 (ENCB).

SOUTH AMERICA: BOLIVIA: DEPT. UNKNOWN: no locality, no date, Bang 2920 (GH, MO).

BRAZIL: MINAS GERAIS: Caldas, 28 Oct 1868, Regnell 1458 (C). RIO GRANDE DO SUL: Pôrto Alegre, Jan 1929, Jürgens 164 (B), Jan 1929, Jürgens 169 (B); Ponta Grossa, Pôrto Alegre, 8.1.1934, Orth 690 (C, GH, MO, UC); São Leopoldo, Pôrto Alegre, 6.10.1937, Orth 718 (C, GH, UC); Pôrto Alegre, Feb 1898, Reineck s.n. (LY), Nov 1898, Reineck \& Czermack 443 (M).

PARAGUAY: CENTRAL: near Villeta, 16 Nov 1969, Pedersen 9323 (C).
URUGUAY: ARTIGAS: Catalán, Nov 1927, Herter 341a (M). CANELONES: Bañados de Carrasco, no date, Caldevilla s.n. (MICH); Parque Plata, 7 Dec 1947, Herter 3411 (B). FLORIDA: La Palma, 11-16 Apr 1938, Herter 341h (B). MONTEVIDEO: Malvin, Dec 1925, Herter 341 (B, GH, M, MO, UC); Montevideo, 2 Jan 1931, Osten 22164 (GH). ROCHA: Palmares de Castillos, 25 km N of Castillos, 22 Jan 1944, Bartlett 21391 (MICH, TEX, UC). SAN JOSE: Barra Sta. Lucía, 30 Dec 1930, Osten 22166 (GH).

ARGENTINA: BUENOS AIRES: 30 km SE of La Plata, on Magdalena road, 9 Dec 1938, Eyerdam et al. 23387 (GH, MO, UC); 10 km N of Mar del Plata, 11 Dec 1938, Eyerdam \& Beetle 23630 (UC); between Cascallares and Copetonas, 22 Apr 1949, Pedersen 351 (C). CORDOBA: Sierra Achala, Jan 1877, Hieronymus 788 (B). CORRIENTES: Mburucuyá, Santa María, 3 Dec 1951, Pedersen 1360 (C); Mburucuyá, Santa Teresa, 18 Jan 1953, Pedersen 1930 (C), 3 Nov 1965, Pedersen 7481 (C); Empedrado, Las Tres Marłas, 15 Dec 1954, Pedersen 3042 (C), 18 Oct 1964, Pedersen 7098 (C); Empedrado, La Yela, 1 June 1972, Pedersen 10175 (C); Curuzú Cuatiá, Aguay, 13 Nov 1964, Pedersen 7128 (C); Saladas, Pago Los Deseos, 6 Mar 1969, Pedersen 9054 (C); Santo Tomé, Paso Concepción, 23 Apr 1969, Pedersen 9106 (C); Concepción, Buena Vista, 12 Dec 1972, Pedersen 10267 (C). ENTRE RIOS: Concordia, 15 Dec 1957, Pedersen 4728 (C); Federación, Buena Esperanza, 23 Oct 1961, Pedersen 6264 (C, L); Uruguay, La Selmira, 20 Nov 1964, Pedersen 7215 (C), 7263 (C); Las Aguadas, 26 Nov 1964, Pedersen 7334 (C); Colón, 2 Feb 1967, Pedersen 8032 (C); Federación, near Villa del Rosano, 26 Mar 1967, Pedersen 8150 (C).

CHILE: ACONCAGUA: Valle de Marga-Marga, coast ranges southeasterly from Valparaiso, no date, Jaffuel \& Pirion 3302 (GH), 3308 (GH); Depto. Los Andes, Cerro Cache, ca 18 km E of La Ligua, 29 Dec 1938, Morrison 17043 (MO, UC). BIO-BIO: and der Laguna Laja, 31 Jan 1972, Zölner 6244 (L). CONCEPCION: Concepción, 1893-1896, Neger s.n. (M). VALDIVIA: "Ouinchilca," Dec 1941, Hollermayer 1347 (UC); Panguipulli, 6 Mar 1928, Hollermayer 2348 (GH); near Trumao Mission, 2 km W of Trumao, 21 Dec 1935, West 4840 (GH, UC).

Cyperus reflexus Vahl var. fraternus (Kunth) Kuntze, Rev. Gen. 3, pt. 2: 334. 1898. Basionym: Cyperus fraternus Kunth, Enum. Pl. 2: 42. 1837. Type: Brazil, no locality specified, Sello s.n. (B!, holotype). Figure 13 (I-K).

Cyperus surinamensis Rottb $\phi 1$ var. strictus Kukenthal, Pflanzenreich IV. 20 (Heft 101): 175. 1936. Type: Paraguay, in regione cursus superioris fluminis Apa, Dec 1901, Hassler 8195 (B!, holotype; BM!, GH!, LY!, MICH!, NY!, UC!, isotypes).

Leaf sheath $2-13 \mathrm{~cm}$ long; involucral bracts $2(-4)$, up to 18 cm long and $1.5-3 \mathrm{~mm}$ wide; compound inflorescence (excluding leafy bracts) up to $4(-8) \mathrm{cm}$ long; primary peduncles absent or $2-4$, up to 4 cm long and ca. 0.5 mm wide; secondary peduncles absent; primary heads $12-20 \mathrm{~mm}$ wide, with $25-60$ spikelets (up to 80 in sessile heads); bracteoles $2.5-3 \mathrm{~mm}$ long, $7-10$-veined; spikelets $6-11 \mathrm{~mm}$ long, $1.5-2.3 \mathrm{~mm}$ wide, with (18-) $24-34(-42)$ scales; rachilla with transverse scale scars 0.3 mm apart on each side; sides of scale usually stramineous but occasionally brown, reddish brown, or pale red; achene filling three-fifths to three-fourths of the scale, brown or reddish brown, narrowly trigonous, obtusely angled, ca three times longer than wide, $0.9-1.4 \mathrm{~mm}$ long (total length), the body $0.8-1.2 \mathrm{~mm}$ long; achenial surfaces 0.3 mm wide, narrowly ovate or narrowly elliptic, planar.

Distribution. In the United States known only from Texas; in Mexico, from San Luis Potosí, Michoacán, Jalisco, and Veracruz; in South America, from Brazil, Argentina, and Paraguay. Occurring on low floodable ground by rivers or around lakes, or in clayey grasslands at elevations from 150 to 2300 meters (Fig. 14).

Discussion. Features of the achenes provide the best distinction between the two varieties of $C$. reflexus. In var. fraternus, the narrowly trigonous achenes are about three times longer than wide and have surfaces that are planar. Characteristically, secondary peduncles are completely lacking, and the scales are typically stramineous or light brown when mature, seldom reddish.

It can be speculated that var. fraternus is a hybrid derivative of var. reflexus and C. surinamensis. The achenes of var. fraternus resemble those of $C$. surinamensis, but var. fraternus has smoother stems, shorter spikelets, fewer scales per spikelet, and glossier and longer scales than those of C. surinamensis. Also, var. fraternus exhibits distinctive scaly rhizomes which are lacking in C. surinamensis.

Representative specimens:
UNITED STATES OF AMERICA: TEXAS: MATAGORDA CO: College Port Prairie, 22 Aug 1929, Tharp 9150 (TEX). WALLER CO: Hempstead, 1 June 1873, Hall 679 in part (F, K, NY).

MEXICO: SAN LUIS POTOSI: Sierra de San Miguelito, cerca de Cueva de Mezquite, 9 Nov 1954, Rzedowski 5470 (ENCB); in paludosis Morales, 1876, Schaffner 564 (GH). JALISCO: wet soil near Guadalajara, 10 Oct 1903, Pringle 11724 (CAS, F, GH, MICH, MO, US). MICHOACAN: Morelia, 1/9/1910, Arsène 6654 (US). VERACRUZ: Casitas-Gutiérrez Zamora cerca Ejido Villa Cuauhtémoc, 21 June 1970, Nevling \& Gomez-Pompa 1179 (WTU).

BRAZIL: PARANA: Pinhaes, 7.1.1909, Dusén 7779 (BM); Tibagi, Rio Tibagi, 10 Oct 1965, Hatschbach 12898 (F, UC). RIO GRANDE DO SUL: Farroupilha, 18 Nov 1957, Camargo 2568 (B); Taquari, 14 Dec 1957, Camargo 2971 (B); Pôrto Alegre, p. Sta. Maria, 1.1.1956, Camargo 58893 (B); Mun. Rio Pardo, Oct 1922, Jürgens 18 (B). SAO PAULO: Butantan, 10 Jan 1921, Gehrt 5418 (GH), Hoehne 5418 (B, GH). SANTA CATARINA: Fazenda Frei Rogério, Pôrto União, 6.1.1962, Reitz \& Klein 11.625 (L), 26 Oct 1962, Reitz \& Klein 13.614 (L); Morro do Pinheiro Séco, Lajis, 17 Dec 1962, Reitz \& Klein 14.010 (UC).

PARAGUAY: MISIONES: Santiago, La Soledad, 17 Oct 1967, Pedersen 8633 (C), 18 Oct 1967, Pedersen 8647 (C). SAN PEDRO: Distr. Lima, Est. "Carumbe," 28 Nov 1969, Pedersen 9425 (L, UC).

ARGENTINA: CORRIENTES: Depto. Empedrado, "La Yela," 21 Apr 1956, Pedersen 3887 (UC); Depto. Mburucuyá, 26 Nov 1959, Pedersen 5299 (A, L); Itati, Tuyuti, 29 Sep 1972, Pedersen 10196 (C).

Cyperus surinamensis Rottb $\phi 11$, Descr. Ic. Rar. 35. Pl. 6, fig. 5. 1773. Type: Not located, but description and figure in protologue adequate for typification. Figure 13 (A-D).

Cyperus denticulatus Schrader ex J. A. Schultes in Roemer \& Schultes, Syst. Veg. Mantiss. 2: 104. 1824. Type: Brasil, Prinz von Wied-Neuwied ["In Brasilia, Princ. Ser. Max. Neowid."] (LE?, holotype, not seen).

Cyperus subenervius Steudel, Syn. Pl. Glum. 2 [Syn. Pl. Cyp.]: 27. 1854. Type: Uruguay, Montevideo, Deloche s.n. (not seen, but description applicable).

Cyperus bipontini Böckeler, Flora 40: 33. 1857. Type: Mexico, Veracruz, Sartorius s.n. (B!, holotype).

Cyperus surinamensis Rottb $\phi 11$ var. viridis Böckeler, Linnaea 35: 555. 1868. Type: Brasil, Prov. Sta. Catharina, Itajahy, 12 Nov 1886, Schenck 1116 (B!, neotype, annotated by Böckeler).

Cyperus surinamensis Rottb $\phi 11$ var. lutescens Böckeler, Linnaea 35:555. 1868. Type: Lagoa Santa, Nov, Warming s.n. (C!, neotype, annotated by Böckeler).

Tufted perennial, seldom an annual, up to $60(-80) \mathrm{cm}$ tall; stems erect, stiff to flexuous, triquetrous to round, retrorsely scabrellate on the upper one-half or for its full length, seldom smooth, grayish green, green, or stramineous, $0.4-2.5 \mathrm{~mm}$ wide distally, $1-5 \mathrm{~mm}$ wide at the base; leaves $3-9$, mostly one-half to three-fourths as long as to equalling the stem, up to 65 cm long; leaf sheath $2-8 \mathrm{~cm}$ long, brown or green, seldom reddish, with few inconspicuous transverse septa between the veins, weakly nodulose if at all, occasionally persistent and becoming dark brown and fibrous the second year; leaf blade ( $1.5-$ ) $3-10 \mathrm{~mm}$ wide at mid-length, usually flat, grayish green, green, or stramineous, acute to attenuate at apex; involucral bracts $3-8$, foliaceous and spreading, $2-15(-31) \mathrm{cm}$ long, $1-4 \mathrm{~mm}$ wide, sheathless or with a sheath less than 1 mm long, usually flat, grayish green, green, or stramineous, rarely with inconspicuous transverse septa between the veins, seldom nodulose, apically attenuate; compound inflorescence $1-8(-14) \mathrm{cm}$ long; primary peduncles absent or $4-14,1-6(-9) \mathrm{cm}$ long, $0.8-1 \mathrm{~mm}$ wide, round or slightly flattened, usually scabrellate, slightly flexuous; secondary peduncles absent or (1-) 5-7, $1(-3) \mathrm{cm}$ long, ca 0.5 mm wide, straight; heads hemispherical, the primary ones $12-24 \mathrm{~mm}$ wide and with $10-55$ spikelets, the secondary ones $10-15 \mathrm{~mm}$ wide and with 6-20 ( -30 ) spikelets; bracteoles ovate, $1.8-2.5 \mathrm{~mm}$ long, 5-9-veined, membranous or coriaceous, apically acute; prophyll of spikelet $0.1-1$ mm long, hyaline and membranous, without veins; spikelets oblong or nearly linear, (3-) 4-14 (-16) mm long, 1.5-2 ( -2.5 ) mm wide, apically acute, with (10-) $20-58$ ( -72 ) scales; rachilla $0.15-0.2 \mathrm{~mm}$ wide, 0.1 mm thick, straight or arched, adaxially yellowish brown and mostly with reddish glandular, longitudinal striations, the transverse scale scars $0.3-0.5 \mathrm{~mm}$ apart on each side; scale angles ca $45^{\circ}$; scales $1-1.5 \mathrm{~mm}$ long, $0.8-1 \mathrm{~mm}$ wide, or $0.3-0.6 \mathrm{~mm}$ wide and triangular in lateral view, adaxially with few red glands, distinctly bicarinate basally, apically acute or obtuse and straight or subtly excurved, the proximal abaxial groove between the two keels $0.3-0.4(-0.6) \mathrm{mm}$ long; medial part of scale firmly membranous, elevated on the veins and concave between, green or stramineous, often scabrellate distally; sides of scale membranous and reticulate with conspicuous cells, usually pale yellow, sometimes light brown, seldom reddish brown, the margins hyaline and revolute on the distal two-thirds of the scale, basally attached to the rachilla for $0.15-0.2 \mathrm{~mm}$; stamen solitary, $1-1.5 \mathrm{~mm}$ long, the filament $0.9-1.3 \mathrm{~mm}$ long, the anther ca 0.5 mm long; pollen ca $25 \mu$ in diameter; style ca 1 mm long, the stigmatic branches ca 0.5 mm long; achene filling one-half to three-fifths of the scale, radially symmetric, light to dark brown or reddish brown, narrowly (and weakly) trigonous, obtusely angled, about three times longer than wide, $0.7-0.9 \mathrm{~mm}$ long (total length), the stipitate base less than 0.1 mm long, the body $0.6(-0.8) \mathrm{mm}$ long, and the slender apical beak up to 0.1 mm long; achenial surfaces equal in width, $0.2-0.3 \mathrm{~mm}$ wide, elliptic, planar.

Distribution. In the United States C. surinamensis occurs from Florida west to Texas, and in Oklahoma and Kansas; it is widely distributed in the Greater and Lesser Antilles, Mexico, Central America, and South America. It grows on peaty or sandy soils around ponds, or in grassy meadows, marshes, depressions in pine forests, cypress
or mangrove swamps, sandy prairies, dry woodlands with Bursera and cacti or leguminous shrubs and cacti, or on muddy banks of streams in tropical forest, from sea level to 1830 meters in elevation (Fig. 14).

Discussion. Cyperus surinamensis is one of the most distinct taxa in the Luzulae group and is characterized by slender, scabrellate stems, small scales with reticulate surfaces, and narrowly trigonous achenes. Its wide distribution could have been achieved or aided by easy dispersal of the small achenes and the readily deciduous scales. Specimens collected in Jamaica and Puerto Rico, some from Mexico, and one from Louisiana (Thieret 31645) exhibit smooth stems that are slightly larger than average. Variability of the number and length of primary peduncles and of the size of the heads is evident, but of no taxonomic significance. Although most populations are perennial, a few appear to be annual.

Representative specimens:
UNITED STATES OF AMERICA: GEORGIA: DECATUR CO: NE of Bainbridge, 14 Nov 1974, Godfrey 74103 (LL).

FLORIDA: ALACHUA CO: sandy strand of Burnette Lake, E of Alachua, 30 July 1927, Wiegand \& Manning 506 (GH). CHARLOTTE CO: 15 mi NNW of Ft. Meyers, 29 July 1958, Kral 7529 (GH). CITRUS CO: Homasassa Springs, 7 June 1958, Kral \& Kral 6694 (GH). COLLIER CO: N of Golden Gate subdivision, 20 July 1965, Lakela 20927 (BM). DADE CO: glades S of Long Pine Key, 24 Apr 1952, Robertson 212 (GH). DUVAL CO: near Jacksonville, 13 July 1894, Curtiss 5003 (F, GH). GADSDEN CO: no locality or date, Chapman s.n. (GH, K). GILCHRIST CO: 3 mi E of Trenton, 25 July 1961, Godfrey \& Reinert 61080a (DUKE). GULF CO: $1 / 4 \mathrm{mi}$ NW of Port St. Joe, 6 July 1958, Kral \& Kral 7177 (GH). HENDRY CO: About 4 mi W of Labelle, 15 Aug 1963, Henderson 63-1605 (TEX). HILLSBOROUGH CO: vicinity of Gibsonton, 18 Sep 1975, Godfrey 74448 (LL); W of Brandon on hwy. 60, 31 Oct 1960, Lakela 23492 (DUKE); Tampa, 24 Aug 1895, Nash 2475 (GH, MICH). JACKSON CO: ca 2 mi W of Lake Seminole, road to Dellwood, 7 Nov 1965, Godfrey 64920 (TEX). LAKE CO: Eustis, June-July 1894, Hitchcock 2107 (F); 2.2 mi N of Lady Lake, 19 Sep 1965, Ward \& Carmichael 5124 (DUKE). LEON CO: Lake Bradford, 13 July 1955, Godfrey 53638 (DUKE). ORANGE CO: 10 mi E of Orlando, 12 Aug 1957, Kral 5448 (GH). OSCEOLA CO: 1 mi W of Holopaw, 8 June 1960, Ward \& Myint 1959 (DUKE). PALM BEACH CO: N side of Old Okeechobee Road, West Palm Beach, 30 Nov 1968, Cassen 454 (C). POLK CO: along S shore of Lake May, Winter Haven, 31 Dec 1965, Mazzeo 1132 (UC, WTU). PUTNAM CO: near Palatka, 21 May 1935, Scott s.n. (DUKE). SEMINOLE CO: Seminole, W side of Prairie Lake, 10 Nov 1961, Schallert 28655 (BM). TAYLOR CO: 1.2 mi SE of Salem, 7 Oct 1964, Godfrey 64715 (LL). WAKULLA CO: about 2 mi W of Panacea, 1 Aug 1964, Henderson 64-375 (CAS).

ALABAMA: MOBILE CO: eastern outskirts of Mobile along US 31, 5 Sep 1965, Kral 23915 (ENCB).

MISSISSIPPI: JACKSON CO: along hwy. 63 at Escatawpa River, 18 July 1954, Diener 1458 (NO). HARRISON CO: sandy bottoms of Escatawpa River, P. O. Moss Point, 14 Aug 1952, Demaree 32781A (GH).

ARKANSAS: COUNTY NOT KNOWN: central Arkansas, July 1892, Harvey 4 (GH).
LOUISIANA: BEAUREGARD PARISH: Merryville, 26 Oct 1969, Thieret 31918 (DUKE). CALCASIEU PARISH: ca 2.5 mi SE of Moss Bluff, 14 July 1969, Thieret 31645 (LL). ORLEANS PARISH: Audubon Park, 9 May 1935, Penfound s.n. (NO). PLAQUEMINES PARISH: Pointe à la Hache, 5 Aug 1881, Langlois s.n. (DS, F); Mississippi banks, Sep 1880, Langlois 358 (F).

KANSAS: HARVEY CO: 3 mi E, 2 mi N of Burrton, 11 Oct 1967, Stevens 19167 (DS, UC).

OKLAHOMA: BRYAN CO: one mi E of Denison Dam of Lake Texoma, 18 June 1950, Kelting 206 (UC). STEPHENS CO: old Duncan Lake about 8 mi E of Duncan, 22 Sep 1970, Correll \& Correll 29891 (LL).

TEXAS: ARANSAS CO: Aransas Wildlife Refuge, 19 Sep 1968, Fleetwood 9341 (LL). BASTROP CO: McDade, 14 Aug 1936, Tharp s.n. (TEX). CAMERON CO: 25 mi N of Brownsville, 2 July 1941, Runyon 2761 (CAS). CHAMBERS CO: Trinity River delta, ca $1 / 4 \mathrm{mi} \mathrm{S}$ of head of Passes, 15 July 1958, Traverse 817 (LL, TEX). GRIMES CO: in marsh, 28 Sep 1941, Weaver 205 (MICH). GUADALUPE CO: 13 mi S of Seguin, 16 July 1958, Correll \& Johnston 19683 (LL). HARRIS CO: San Jacinto River N., sandy soil, Humble, 8 Aug 1946, Boon 402 (TEX). JIM HOGG CO: 28 mi S of Hebbronville, 25 June 1952, Correll \& Johnston 25534 (LL). KENNEDY CO: Las Norias, 20 July 1943, Runyon 3186. KLEBERG CO: Riviera, 9 Sep 1929, Tharp s.n. (TEX). SAN PATRICIO CO: Welder Wildlife Refuge, along shore of Pollito Lake, 26 Sep 1960, Jones 4275
(TEX). TRAVIS CO: Colorado River at Austin, 7 Nov 1940, Innes 282 (GH); Lake Austin, 24 Nov 1928, Tharp 9202 (TEX). WILLACY CO: Raymondville bordering highway 186, 18 Apr 1941, Runyon 2664 (CAS); Redfish Bay, 3 Mar 1934, Tharp s.n. (TEX).

MEXICO: BAJA CALIFORNIA: Baja California Sur, San José del Cabo, 26 Sep 1890, Brandegee 602 (UC); eastern outskirt of San José del Cabo, 7 Jan 1959, Wiggins 14711 (DS). SONORA: Alamos, Quiricoba, 12 Nov 1933, Gentry 765 (DS, MICH). TAMAULIPAS: E of San José, 17 Feb 1939, LeSueur 22 (TEX); vicinity of Tampico, 1-31 Jan 1910, Palmer 176 (GH, MO, NY, US). AGUASCALIENTES: 16 km al N de Aguascalientes sobre la carretera a Rincón de Romos, 15 Oct 1973, Rzedowski \& McVaugh 728 (MICH). SINALOA: Mazatlán, Dec 1925, Ortega 5935 (DS, GH); vicinity of Culiacán, 21 Apr 1910, Rose et al. 14060 (US); vicinity of Mazatlán, 6 Apr 1910, Rose et al. 14123 (US). NAYARIT: 3 mi NE of Puga, 22 Aug 1959, Feddema \& King 903 (DS, DUKE, ENCB, MICH, TEX); valley of the Río Jesús María near the village of Jesús María, 20 Sep 1960, Feddema 1322 (MICH); vicinity of Acaponeta, 9 Apr 1910, Rose et al. 14235 (NY). JALISCO: 19 km S of Guadalajara, 16 Sep 1961, Detling 8640 (ENCB, MICH); 9 mi S of Yahualica, 6 Nov 1959, McVaugh \& Koelz 264 (ENCB, MICH); Río Blanco, June-Oct 1886, Palmer 191 (DS, GH, MICH, US); wet places near Guadalajara, 15 Nov 1888, Pringle 1786 (F, GH, LL, M, MICH, MO, NY, UC, US); 50 km al N de Guadalajara, 28 Oct 1968, Puga 2376 (ENCB); Llano Verde, cerca de los Corales, Mpio. de Tecalitlán, 25 Oct 1963, Rzedowski 17478 (ENCB, MICH). COLIMA: hwy. 80, ca 80 km from Pacific, 30 May 1973, Burton \& Zarkin 6 (MICH); Colima, July 1897, Palmer 1 (US). MICHOACAN: Puente Jaripo, km 551 carr. México-Guadalajara, 25 Dec 1963, Galicia \& Cruz Fa 1. 453 (ENCB); Cerro de Carboneras above the Rio Cupatizio, ca 22 km S of Uruapan, 16-22 Oct 1961, King \& Soderstrom 4874 (MICH, TEX, UC, US). GUERRERO: 20 mi NE of Acapulco, 20 Aug 1947, Barkley et al. 17M752 (TEX); Mesa Frijolar, 14 Oct 1936, Hinton 9689 (US); Adama Dist., Sierra Madre del Sur, N of Río Balsas, Santo Tomás, 29 Nov 1937, Mexia 8924 (B, CAS, GH, MO, NY, UC); Acapulco and vicinity, Oct 1894-Mar 1895, Palmer 291 (GH, US); Acapulco, 25 June 1952, Troublefield \& Rowell $2816 B$ (MICH). MORELOS: barranca al W de Cuernavaca, 6 Nov 1967, Flores Crespo 190 (ENCB); Cuernavaca, 3 Jan 1899, Deam 4 (GH, MICH, US); Colonia Las Guacamayas, 5 Aug 1966, Pascoe 288 (ENCB). MEXICO: Dist. Temascaltepec, Ixtapan, 16 July 1932, Hinton 1067 (DS, NY), 1 Apr 1933, Hinton 3732 (US), 27 Jan 1936, Hinton et al. 8884 (US). PUEBLA: Orizaba, 29 July 1891, Seaton 64 (GH, NY, US); 15 km SE of Izúcar de Matamoros, sobre la carretera a Acatlán, 29 Nov 1972, Rzedowski 28949 (ENCB). VERACRUZ: Río Maquina, Montepio, Mpio. de San Andrés Tuxtla, 20 Mar 1965, Cruz Cisneros 153 (ENCB); near the city of Veracruz, 23 Jan 1906, Greenman 30 (GH); SW edge of Coatzacoalcos, 2 July 1969, Marcks \& Marcks 875 (LL); Coatzacoalcos, 21 Mar 1910, Orcutt 3257 (MICH, MO, US); Antigua, Sep 1912, Purpus 6247 (GH, MO, UC, US); 6 km al S de Ciudad Alemán, 20 Mar 1965, González Quintero 549 (ENCB); Montepio, 19 km al E de Catemaco, 19 Mar 1965, Gonzalez Quintero 2203 (ENCB); arroyo en Potrero 2 km NW de Laguna Verde, 26 June 1972, Vazquez 865 (F). OAXACA: Valley of Oaxaca, 19 Apr 1896, Conzatti 92 (GH); canteras de Ixcotel, 24 Oct 1932, Conzatti 4802 (MICH); $1 / 2 \mathrm{~km}$ E of Tehuantepec, 30 June 1958, King 308 (MICH); 4 km NW of Zanatepec, 10 July 1958, King 485 (ENCB, MICH); 2 km N of Ixhuatán, 23 July 1959, King 1993 (TEX); near San Gabriel, 13 Feb 1965, McVaugh 22413 (ENCB, MICH); vicinity of Cuicatlán, 8-24 Oct 1894, Nelson 1665 E (US), 1665 (F); near Tomellin, 2-3 Sep 1905, Rose et al. 10049 (US). CHIAPAS: Plain below Venustiano Carranza (San Bartolomé), 30 July 1958, Kaplan 279 (F); Escuintla, 1 Oct 1936, Matuda 298 (GH, MICH). TABASCO: Playa Azul, 22 km WNW of Paraíso, 5 May 1963, Barlow 32/2 (GH); Playa Limón-Paraíso, 23 Aug 1962, Guerrero O. s.n. (ENCB); near Santa Ana, 1962, Marcks 62c/12 (MICH); Santa Anita, 5 Feb 1890, Rovirosa 707 (US). YUCATAN: Progreso, 11-15 Aug 1932, Swallen 2962 (MICH, US).

BRITISH HONDURAS: BELIZE: 3 mi N of Sibun River, 9 mi S of Belize, 24 Aug 1936, O'Neill 8981 (GH, UC); New Town, 4 Sep 1932, Schipp 922 (GH, MICH, MO, NY, UC).

GUATEMALA: AMATITLAN: Morán, Laguna near Izabal, 30 Jan 1906, Kellerman 6726 (F, US). CHIMALTENANGO: near Finca La Alameda, near Chimaltenango, 7 Dec 1938, Standley 59150 (F). ESCUINTLA: along Río Guacalate, NW of Escuintla, 14 Mar 1941, Standley 89328 (F). HUEHUETENANGO: along Río Cuilco, between Cuilco and Aldea of San Juan, $21 / 2 \mathrm{mi}$ W of Cuilco, 18 Aug 1942, Steyermark 50850 (F). IZABAL: vicinity of Quiriguá, 15-31 May 1922, Standley 24060 (GH, MO). JUTIAPA: vicinity of Jutiapa, 24 Oct-5 Nov 1940, Standley 74915 (F). SAN MARCOS: Río Suchiate, just W of Ayutla, 18 Mar 1940, Steyermark 38032 (F). SANTA ROSA: Cuajiniquilapa, Sep 1893, Heyde \& Lux 6263 (GH, MICH). SOLOLA: 1 km N of Panajachel, 21 June 1970, Harmon \& Dwyer 2635 (ENCB). SUCHITEPEQUEZ: between Tiquisate and Río Bravo, 19 June 1942, Steyermark 47867 (UC).

EL SALVADOR: LA LIBERTAD: vicinity of Alteos, 17 Apr 1922, Standley 23396 (GH, US). SAN VICENTE: Laguna de Apastepeque, 23 Oct 1950, Fassett 28341 (F, GH); vicinity of San Vicente, 2-11 Mar 1922, Standley 21279 (GH, US). SONSONATE: vicinity of Armenia, 18 Apr 1922, Standley 23518 (GH, NY, US).

HONDURAS: ATLANTIDA: vicinity of Tela, 14 Dec 1927-15 Mar 1928, Standley 53735 (US), 54788 (US). COMAYAGUA: E1 Banco, 3 Apr 1945, Rodriguez 2636 (F); vicinity of Comayagua, 12-23 Mar 1947, Standley \& Chacón 5997 (F); plain near Siguatepeque, 7 Nov 1936, Yuncker et al. 5804 (GH, MICH, MO). MORAZAN: vicinity of El Zamorano, 22 July 1949, Standley 21548 (F); Tegucigalpa, 8 Sep 1946, Williams \& Molina R. 10508 (A, MICH, UC).

NICARAGUA: MANAGUA: Lake Managua, vicinity of Managua, 24 June 1923, Maxon 7292 (GH, US); Massachuapa, along stream 200 m from beach, 26 Jan 1969, Stevens \& Stergios 171 (MSC). ZELAYA: Corn Island, Waula Point, 9 Mar 1971, Svenson 4414 (BM).

COSTA RICA: GUANACASTE: 21 km N of Liberia, 21 July 1966, Davidse \& Pohl 803 (MO); Finca la Taboga, 13 km SW of Cañas, 16 Aug 1968, Davidse \& Pohl 1214 (F, MO); 10 km S of Cañas, 10 Mar 1965, Godfrey 66955 (MO); Comelco, property near Bagaces, 28 June 1971, Opler 266 (F). LIMON: Río Grande de Terraba, El Paso, Feb 1891, Tonduz 3578(US); at the beach of Boca Banana, Feb 1895, Tonduz 9124 (US). PUNTARENAS: 1 km NW of Boca de Barranca, 15 Aug 1968, Davidse \& Pohl 1208 (MO); roadside near Boca Barranca, 20 Aug 1938, Worth 8907 (GH, MO, UC).

PANAMA: CANAL ZONE: between Gorgona and Tabernilla, 15 Sep 1911, Hitchcock 8104 (US); between Frijoles \& Monte Lirio, 18 Oct 1922, Killip 12178 (GH, US); vicinity of Fort Sherman, 15 Jan 1924, Standley 31170 (US); Darien Station, 19 Jan 1924, Standley 31540 (US). COLON: Miguel de la Borda, 20 Apr 1970, Croat 9815 (MO); between Matlas Hernández \& Juan Díaz, 21 Jan 1924, Standley 31954 (US).

CUBA: PINAR DEL RIO: vicinity of Herradura, 26-30 Aug 1910, Britton et al. 6407 (NY, US); Nueva Gerona, 28 Nov 1956, Killip 45762 (US); Vedado, Habana, 5 Jan 1940, Bro. Leon 17438 (GH); vicinity of La Gloria, Camagüey, 30 Jan 1909, Shafer 173 (BISH, US); vicinity of Sumidero, 6-8 Aug 1912, Shafer \& Bro. Leon 13658 (NY, US).

JAMAICA: ST. MARY PARISH: nr. Annotto Bay, 29 May 1960, Adams 7228 (BM, M).
HAITI: NORD-OUEST: vicinity of St. Louis-du-Nord, 7 Apr 1929, Leonard \& Leonard 14413 (US).

DOMINICAN REPUBLIC: MONTECRISTI: Guayubín, 13-21 Feb 1921, Abbott 976 (NY, US). TRUJILLO: Valdesia Valley, 19 Nov 1947, Allard 17031 (NY, US), 19 Nov 1947, Allard 17050a (US).

PUERTO RICO: ARECIBO: near railroad track, from Manatí to Vega Baja, 20 July 1901, Underwood \& Griggs 973 (US). BAYAMON: near Bayamón, 2 Nov 1963, Br. A. Liogier 10339 (F). GUAYAMA: Mpio. de Guayama, 27 July 1965, Stimson 1739 (DUKE, GH, LL, MICH, MO, UC, US). HUMACAO: Humacao, July 1880, Eggers s.n. (LY), June 1881, Eggers s.n. (LY); Mt. Britton, Luquillo National Park, 20 Nov 1937, Jones 11015 (GH); Luquillo Mountains, El Yunque National Forest, 11 Aug 1965, Stimson 1925 (DUKE). MAYAGUEZ: Mayaguez, 31 Mar 1913, Britton 2360 (US); along the railroad north of Mayaguez, 12 Feb 1900, Heller 4578 (F, L).

GUADELOUPE: no locality, 15 Sep 1894, Duss 3524 (C, US).
MARTINIQUE: Rivière-Salee, 1899, Duss 690 (NY), 690 (MO); Morne Rouge, 7 Jan 1949, Stehlé 6486 (US).

ST. LUCIA: Soufrière, along roadsides, 3 June 1958, Proctor 18191 (A, BM).
GRENADA: St. Georges, 8 Apr 1905, Braodway s.n. (GH, NY); Grenville, 30 Oct-11 Dec 1957, Proctor 16885 (A, BM, US).

TRINIDAD: coastal plain, Carenage, 25 Feb 1920, Britton \& Hazen 2 (GH); Moruga seashore, 5 June 1908, Broadway 2388 (M); Port-of-Spain, 9 Oct 1925, Broadway 5815 (DUKE, MO, UC).

TOBAGO: ad Bucolil, Oct 1889, Eggers 5385 (C); Caledonia, 14 Jan 1953, Hunnewell 19903 (GH).

SOUTH AMERICA: COLOMBIA: ANTIOQUIA: ca 1 km W of Turbo, 11 Mar 1962, Feddema 1831 (MICH). ATLANTICO: Barranquilla and vicinity, Aug 1927, Bro. Elias 310 (GH, NY); Las Flores near Barranquilla, Jan 1932, Bro. Paul 943 (F). BOLIVAR: Canabetal, Río Magdalena, 15 Jan 1918, Pennell 3888 (MO). VALLE DEL CAUCA: Buenaventura, 27 May 1939, Alston 8674 (BM).

VENEZUELA: AMAZONAS (TERR.): Pto. Ayacucho, 23 May 1940, Williams 13084 (F). BOLIVAR: along rocky cascades of Río Upata, W of Upata, 31 July 1944, Steyermark 57550 (F). TRUJILLO: $1 / 4 \mathrm{mi}$ inland from La Ceiba, 13 Mar 1931, Reed 939 (B).

GUYANA: no locality, Jan 1962, Reichgelt s.n. (L).
SURINAM: NICKERIE: 45 km above confluence with Lucie River, vic. Kayser Airstrip, 25 Aug 1963, Irwin et al. 55229 (F, NY). PARAMARIBO: Paramaribo, 28 Nov 1955, Jonker 33 (NO, UC); Tafelberg (Table Mt), Charlesburg Rift, 3 km N of Paramaribo, 5 Apr 1944, Maguire 22735 (MICH).

FRENCH GUIANA: CAYENNE: Cayenne, Mar 1910, Santini s.n. (L).
ECUADOR: GUAYAS: Balao, 1898, Eggers 14106 (L), Feb 1892, Eggers 14489 (M), Mar 1892, Eggers 14522 (L, M). LOS RIOS: Est. Exp. Tro. Hda., "Picilingue," 15 June 1951, White 5639 (NO).

PERU: CAJAMARCA: Prov. Cutervo, Valley of Río Sucse, west of Socota, 9 Dec 1938, Stork \& Horton 10107 (UC). LAMBAYEQUE: km 28 E of Olmos, Muro Highway between Olmos and Jaén, 7 Jan 1964, Hutchison \& Wright 3461 (UC), road to Jaen, km 17 E of Olmos at the Bridge of Silence, 18 Mar 1964, Hutchison \& Wright 4426 (UC). SAN MARTIN: Arroyo Bravo, about 40 km from Tingo María on highway to Pucallpa, 180 km from Huánuco at bridge over Arroyo Bravo, 1 Nov 1949-5 Jan 1950, Allard 20389 (UC).

BOLIVIA: SANTA CRUZ: Choreti, 3 mi from Camiri, 11 Sep 1949, Brooke 5609 (BM); Buenavista, 27 Dec 1924, Steinbach 6821 (B, F). TARIJA: Villa Montes, Pilcomayo, 20 Oct 1927, Troll 434 (M).

BRAZIL: BAHIA: ca 10 km S of Cocos, 15 Mar 1972, Anderson et al. 37011 (NY). CEARA:margin of Lagoa Mecejana, Mecejana, 28 July 1935, Drouet 2146 (MICH); Fortaleza, 12 Aug 1935, Drouet 2221 (F, MO). GOIAS: Serra Geral do Paranã, 30 km by road S of Saõ João de Aliança, 23 Mar 1973, Anderson 7791 (NY). MARANHAO: Mun. de Lorêto, about 35 km S of Lorêto, 23 Mar 1962, Eiten \& Eiten 3750 (L). MINAS GERAIS: N. Minas, Várzea de Palma, 23 Nov 1962, Duarte 7426 (M). PARA: Ilha de Marajó, 19-20 June 1934, Swallen 4948 (B). PERNAMBUCO: Tapera, 18 June 1933, Pickel 2611 (B, CAS). RIO DE JANEIRO: Río de Janeiro, Sep, Martius 5126 (M). RIO GRANDE DO SUL: Ponta Grossa, Pôrto Alegre, Jan 1929, Jurgens 168 (B); P. Alegre, 14 Jan 1933, Orth 702 (CAS, MO). SANTA CATARINA: Itajaí, 26 Nov 1961, Klein 2.844 (L, UC), 13 May 1962, Klein 2.897 (L, UC). SAO PAULO: São Paulo, 2/4/1926, Hoehne \& Gehrt 17714 (B); Santo, Guarjua, 25 July 1907, Usteri 9372 (B).

PARAGUAY: SAN PEDRO: Distr. Lima, "Carumbe," 29 Nov 1969, Pedersen 9433 (C, L).
ARGENTINA: CORRIENTES: Depto. Concepción, Tabay, 1-11-1965, Krapovickas \& Cristobal 11618 (UC); Depto. Lavalle, "La Pastoril," 25 Nov 1971, Pedersen 10035 (C); Depto. Mburucuyá, Santa Teresa, 6/12/1951, Pedersen 1373 (C, MO, NY). SANTA FE: Bajada Grande, 20 Nov 1925, Barros 200 (F). SANTIAGO DEL ESTERO: Río Hondo, 25 Feb 1941, Ousset 39 (GH). TUCUMAN: Tucumán, 18 Nov 1913, Monetti 1316 (GH).

## Cyperus virens Michaux, Fl. Bor.-Amer. 1: 28. 1803.

Perennial, tufted or sometimes shortly rhizomatous; stems generally rigidly erect, triquetrous, roughly scabrous or scabrellate (rarely smooth) on the acute and often winged angles, green or stramineous, $2-5 \mathrm{~mm}$ wide distally, $3-7(-12) \mathrm{mm}$ wide at the base; leaves $4-12$, one-half as long as to slightly exceeding the stem, (20-) $40-86 \mathrm{~cm}$ long; leaf sheath brown, with prominent transverse septa between the red veins, evidently nodulose, often persistent and becoming dark brown to black and fibrous the second year; leaf blade usually flat, grayish green, light green or stramineous, with conspicuous transverse septa between the veins, nodulose, attenuate at apex; involucral bracts (4-) 6-9 (-11), foliaceous and spreading, sheathless or with a sheath 2 mm long or less, usually flat, grayish green, light green or stramineous, with conspicuous transverse septa between the veins, nodulose, the apices attenuate; compound inflorescence $3-17 \mathrm{~cm}$ long; primary peduncles $2-15$, up to 14 cm long, $1-2 \mathrm{~mm}$ wide, triquetrous, scabrellate and winged on the angles, rigid; secondary peduncles absent or $1-5$, up to 3 cm long, $0.5-1 \mathrm{~mm}$ wide, triquetrous, scabrellate and minutely winged on the angles, straight; heads hemispherical, the primary ones $10-30(-35) \mathrm{mm}$ wide, the secondary ones $8-15 \mathrm{~mm}$ wide; bracteoles ovate, $5-9$-veined, firmly membranous to crustaceous, apically acute, acuminate or cuspidate; prophyll of spikelet ca 1 mm long, firmly membranous, $7-9$-veined; spikelets narrowly ovate or oblong, apically acute; rachilla $0.25-0.3 \mathrm{~mm}$ wide, ca 0.1 mm thick, mostly straight (only slightly arched), dark reddish brown; scales triangular in lateral view, adaxially with reddish glands in longitudinal striations, distinctly to weakly bicarinate basally, apically acute to mucronate and straight; medial part of scale chartaceous or subcartilaginous, sometimes scabrellate distally; sides of scale firmly membranous to crustaceous, roughened and reticulate with large cells when young but becoming smooth and glossy at maturity, the margins revolute on the upper three-fourths of the scales; stamens one or two, $1.5-2.5 \mathrm{~mm}$ long, the filaments $1.2-2 \mathrm{~mm}$ long, the anthers $0.8-1 \mathrm{~mm}$ long; pollen $20-30 \mu$ in diameter; achene radially to bilaterally symmetric, rarely slightly asymmetric, (1-) $1.2-1.5 \mathrm{~mm}$ long (total length), the stipitate base less than 0.15 mm long, sometimes broadened, the slender apical beak $0.1-0.15 \mathrm{~mm}$ long; achenial surfaces equal or slightly unequal in width.

Discussion. Cyperus virens is the most variable of the species in the Luzulae group and has many characters considered to be generalized. It is the best candidate for the ancestral type from which the other taxa might have evolved. It is a widely distributed species with four varieties, all of which are allopatric as far as can be determined. Variety virens is widespread throughout North and South America; variety montanus is restricted to the southern part of South America; and var. drummondii and var. minarum have disjunctive distributions that span both continents. The four varieties share the following: foliage leaves and involucral bracts that are conspicuously nodulose and transversely septate, and triquetrous stems that are scabrous and winged. These features are not found in combination in related taxa. The variation evident in some collections with regard to scale dimensions and achene features prevents the elevation of these taxa to specific rank.

Cyperus virens Michaux var. virens. Type: USA, Carolina, Michaux s.n. (P, holotype; photograph of holotype, GH!). Figure 15 (A-D).

Cyperus formosus Vahl, Enum. Pl. 2: 327. 1806. Type: no locality specified, Fuspen s.n. (C!, isotype).

Cyperus baenitzii Böckeler, Flora 61: 140. 1878. Type: Argentina, Concepción del Uruguay, Apr 1877, Lorentz 139 (B!, holotype).

Cyperus surinamensis Rottb $\phi 11$ var. formosus (Vahl) Kukenthal, Repert. Spec. Nov. Regni Veg. 32: 74. 1933.

Plant (40-) $60-120 \mathrm{~cm}$ tall; leaf sheath $2-12(-20) \mathrm{cm}$ long; leaf blade (4.5-) $7-14 \mathrm{~mm}$ wide at mid-length; involucral bracts up to 50 cm long, up to 14 mm wide; primary peduncles $6-12(-14)$, up to 14 cm long; secondary peduncles, when evident, up to 3 cm long; primary heads with $10-50$ spikelets, the secondary ones with $9-15$ ( -40 ) spikelets; bracteoles $3-3.5 \mathrm{~mm}$ long; spikelets (5-) $7-15 \mathrm{~mm}$ long, $2-3.3 \mathrm{~mm}$ wide, with (12-) 16-30 (-36) scales; rachilla with transverse scale scars $0.5-0.6 \mathrm{~mm}$ apart on each side; scale angles $30^{\circ}-45^{\circ}$ (-rarely $60^{\circ}$ ); scales $1.5-2.1(-2.4) \mathrm{mm}$ long, $0.9-1.2(-1.5) \mathrm{mm}$ wide, or $0.4-0.6 \mathrm{~mm}$ wide in lateral view, the proximal abaxial groove between the two keels $0.7-1 \mathrm{~mm}$ long; medial part of scale green when young, ripening to stramineous or light brown, seldom reddish brown; sides of scale light brown to golden brown (seldom reddish brown), basally attached to the rachilla for 0.2 mm ; stamens one or two, $1.5-2.5 \mathrm{~mm}$ long, the filaments $1.2-2 \mathrm{~mm}$ long, the anthers $0.8-1 \mathrm{~mm}$ long; style $0.8-1 \mathrm{~mm}$ long, the stigmatic branches ca 0.6 mm long; achene filling one-half to three-fourths of the scales, radially or bilaterally symmetric, brown or reddish brown, narrowly trigonous, obtusely angled, three to five times longer than wide, (1-) $1.2-1.5 \mathrm{~mm}$ long (total length), the body $0.9-1.1 \mathrm{~mm}$ long; achenial surfaces equal or unequal in width, $0.3-0.5 \mathrm{~mm}$ wide, the adaxial surface sometimes 0.1 mm wider than the two abaxial ones, elliptic or narrowly ovate, planar or slightly concave.

Distribution. Widely distributed from the southeastern United States south through central Mexico to Colombia, Venezuela, Brazil, Paraguay, and Argentina. Habitats include brackish cypress-tupelo swamps, sand pits, rice and wheat fields, wet roadside ditches, swales, irrigation canals, depressions in pine-oak forests or Celtis groves, from sea level to 2640 meters in elevation (Fig. 16).

Discussion. The distinguishing features for variety virens are generally those for the species, but in habit it is larger than varieties drummondii or minarum. There are morphological trends evident for this taxon along a north-south gradient. With more northern latitudes, there is an increase in the sizes of achenes, scales, and stems and in the number of foliage leaves.

Variants tend to be few. Smooth stems, rather than scabrous ones, are seldom found. In a Chapman specimen from Florida, some of the stipitate bases of the achenes are 0.15 mm wide, about 0.05 mm wider than in most other populations.


Figure 15. A-D. Cyperus virens var. virens (based on Moore 3468); A, inflorescence, $\times 1 / 2$; B, spikelet, $\times 5 ; \mathrm{C}$, scale, $\times 17.5 ; \mathrm{D}$, achene, $\times 17.5$. E-G. Cyperus virens var. drummondii (based on Wiggins 18572 ); E, spikelet, $\times 5$; F, scale, $\times 17.5$; G, achene, $\times 17.5 . \mathrm{H}-\mathrm{K}$. Cyperus virens var. minarum (based on Ton 1265); H, inflorescence, $\times 1 / 2$; I, spikelet, $\times 5$; J, scale, $\times 17.5$; K, achene, $\times 17.5$.

Distorted spikelets infected by a smut, Testicularia cyperi, are found on several specimens (Florida, Henderson 64-425; Louisiana, Demaree 48215; Texas, Gould 6918).

Representative specimens:
UNITED STATES OF AMERICA: NORTH CAROLINA: CARTERET CO: Davis, 14 July 1949, Blomquist 14729 (DUKE). WASHINGTON CO: $1 / 2 \mathrm{mi}$ SE of Plymouth, 4 July 1922, Randolph \& Randolph 752 (GH).


Figure 16. Distribution of Cyperus virens var. virens.

SOUTH CAROLINA: BEAUFORT CO: near Bluffton, 19 June 1936, Correll 5417 (DUKE, GH). BERKELEY CO: 10 mi NE of Marcks Corners, 24 July 1939, Godfrey \& Tryon 888 (GH). JASPER CO: Savannah National Wildlife Refuge, 3 Nov 1960, Hotchkiss 7708 (LL); 4.6 mi NW of Tillman on S-119, 17 Sep 1967, Radford et al. 11490 (BM, C, LL, NO, TEX, UC, WTU).

GEORGIA: BAKER CO: shallow sink dissected by Newton road 3 mi NE of Field Station, 21 Aug 1947, Thorne 6193 (GH). CHATHAM CO: Cockspur Island, 21 June 1938, Eyles 4078 (DUKE); Tybee Island, 27 June 1938, Eyles 4201 (DUKE). DOUGHERTY CO: 6 mi S of Albany, 28 June 1947, Thorne 5002 (GH, NY). JENKINS CO: edge of Magnolia Springs, 8 Aug 1942, Duncan 5621 (MO). MCINTOSH CO: San Domingo State Park, Darien, 11 July 1937, Eyles 2097 (DUKE).

FLORIDA: CALHOUN CO: just E of Blountstown, 6 June 1956, Redfearn 2197 (DUKE, NY). FRANKLIN CO: Apalachicola, July-Sep, Chapman $2135 a$ (C, GH, MO, NY). JACKSON CO: marshy shores of Lake Seminole, N of Sneads, 28 Oct 1958, Godfrey 57890 (DUKE, GH), 12 Aug 1964, Henderson 64-425 (CAS). LAKE CO: vicinity of Eustis, 16-31 May 1894, Nash 841 (GH, K, MICH, NY). LEON CO: 2 mi E of Tallahassee, 16 July 1957, Godfrey 56608 (GH, NY). MADISON CO: marshes at Greenville, 24 June 1956, Godfrey \& Kral 54922 (DUKE, GH). WAKULLA CO: 4 mi E of St. Marks River at Newport, 23 July 1961, Ward 2737 (DUKE).

ALABAMA: BALDWIN CO: S of Warden's Camp, Mobile Delta, 25 July 1947, Lueth L64 (DUKE). MONTGOMERY CO: Montgomery, 1888, McCarthy s.n. (GH).

MISSISSIPPI: JACKSON CO: Ocean Springs, 5 Aug 1889, Earle 1361 (GH), 5 Aug 1889, Tracy 105 (NY). LINCOLN CO: 4 mi SE of Bogue Chitto, 10 Aug 1955, Ray 5395 (GH). PEARL RIVER CO: 3 mi W of Picayune, 27 June 1967, Sargent \& Jones 13766 (TEX).

LOUISIANA: ACADIA PARISH: Crowley, 12 Oct 1911, Chambliss s.n. (NO). ALLEN PARISH: ca 8 mi N of Elton, 20 June 1968, Thieret 29557 (LL). CAMERON PARISH: ca 10 mi W of Holly Beach, ca 30 mi SW of Hackberry, 14 Dec 1957, Reese \& Harris 1536 (GH, NO). EAST BATON ROUGE PARISH: 1 mi E of Baton Rouge, 27 June 1938, Correll \& Correll 9119 (DUKE, GH). IBERIA PARISH: in salt marsh along canal on Avery Island, 11-15 July 1938, Correll 9563 (DUKE). JEFFERSON PARISH: 5 mi S of Marrero on La Fitte Road, 5 June 1948, Ewan 17710K (BM, NO). LAFAYETTE PARISH: 1 mi SE of Broussard, 6 July 1938, Correll \& Correll 9371 (DUKE, GH, NY); ca 5 mi S of Lafayette, 5 Oct 1957, Reese 1414 (GH, NO). ORLEANS PARISH: Audubon Park, 9 July 1928, McArthur s.n. (NO). PLAQUEMINES PARISH: wet lands, Sep 1880, Langlois 363 (F), July 1880, Langlois s.n. (GH). RAPIDES PARISH: vicinity of Alexandria, 8 June 1899 , Ball 594 (GH). RED RIVER PARISH: 11 mi W of Coushatta on U.S. Highway 84 ( 1 mi W of Grand Bayou), 27 July 1956, Shinners 24171 (NO). SABINE PARISH: Sabine River, Toledo Bend Reservoir, 27 June 1963, Demaree 48215 (NO). ST. BERNARD PARISH: bank of La Borgne Canal about 1 mi E of Violet, 31 Aug 1959, Lemaire 1742 (NO). ST. CHARLES PARISH: Willswood, 16 Apr 1961, Eggler s.n. (NO). ST. MARTIN PARISH: 1 mi SW of Breaux Bridge, 10 July 1938, Correll \& Correll 9449 (DUKE, GH). ST. TAMMANY PARISH: Covington, 16 May 1964, Demaree 49988 (NO); Martinville, July 1890, Langlois s.n. (DS, MO). ST. MARY PARISH: Cote Blanche Island, 13 May 1961, Ewan 20325 (BM, NO). TANGIPAHOA PARISH: 4 mi E of Hammond, 26 Sep 1959, Shireman 39 (NY). TERREBONNE PARISH: Houma, 10 July 1942, George \& Shephard s.n. (TEX); near Houma, 30 June 1918, Small s.n. (WTU). VERMILION PARISH: 3.5 mi E (by road) of Gueydan along road to Kaplan, 27 May 1967, Thieret 26331 (TEX).

TEXAS: ARANSAS CO: northern part of Aransas National Wildlife Refuge, 13 June 1953, Johnston 5320.27 (TEX). BASTROP CO: no locality, 14 Aug 1936, Tharp s.n. (NY, TEX, UC). BRAZORIA CO: Angleton, 17 July 1972, Fleetwood 1011A (MO). BRAZOS CO: 6 mi W of Bryan, 29 Sep 1940, Curry 22 (CAS). CAMERON CO: 22 mi N of Brownsville, 30 July 1944, Runyon 3980 (TEX). CHAMBERS CO: Anahuac, 21 July 1929, Tharp 9207 (TEX); Anahuac Natl. Wildlife Refuge, 16 June 1964, Vantries 1 (TEX). FORT BEND CO: Richmond, 4 Sep 1930, Fisher s.n. (MICH). GONZALES CO: 7 mi S of Gonzales, 6 July 1957, Correll \& Johnston 17491 (LL). GUADALUPE CO: no locality, 15 Aug 1940, Kellogg s.n. (TEX, UC). HARDIN CO: $13 / 4 \mathrm{mi}$ NE of Batson, 12 Nov 1945, Cory 50762 (LL). HARRIS CO: 8 mi E of Cypress, 6 Oct 1965, Correll 31923 (LL); Houston, 8 June 1937, Fisher 374 (DS, DUKE, NY, TEX, UC). JEFFERSON CO: about 1 mi N of Nome, 16 Oct 1967, Correll 35152 (LL); 51/2 mi W of Beaumont, 10-5-1934, Cory 11028 (GH). LIBERTY CO: Trinity River bottomland about 1 mi E of Dayton, 25 Oct 1967, Correll 35277 (LL); 7.5 mi S of Clark, 15 June 1955, Gould 6918 (TEX, UC). NACOGDOCHES CO: Attoyac River just N of the Rayburn Reservoir on hwy. 103, 26 Aug 1967, Mitchell 3993 (LL). ORANGE CO: Port of Orange, 27 June 1967, Correll 34280 (LL); Orange, 11 Aug 1880, Letterman 28 (MO, NY). REFUGIO CO: Austwell, 9.7.1929, Tharp s.n. (TEX). SABINE CO: about 1 mi SW of Hemphill, 10 May 1969, Correll 37222 (LL). SAN PATRICIO CO: Odem, 2 June 1922, Tharp 2121 (TEX). RUSK CO: 10.6 mi E of Henderson, 10 Aug 1954, Shinners 14060 (TEX). WALLER CO: Hempstead, 6 June 1872, Hall 680 (GH, K, NY). WILLACY CO: Raymondville, 8 Aug 1941, Fisher 41189 (F, TEX). WILSON CO: Sutherland Springs, 23 July 1944, Cory 45181 (TEX).

CALIFORNIA: FRESNO CO: Near Fresno, 24 Oct 1892, Davis s.n. (MICH); Fresno, irrigating ditches, 24 Sep 1892, Sones 75 (MSC).

MEXICO: SONORA: Sierra Tecurahui, southeastern Sonora, 26-28 Oct 1961, Gentry et al. 19389 (LL, US). SAN LUIS POTOSI: in paludosis San Miguelito, 1877, Schaffner 562 (GH). JALISCO: Río Blanco, June 1886, Palmer 14 (GH, MICH, NY, UC), 8 June 1886, Palmer s.n.,(NY, US). MICHOACAN: vicinity of Morelia, 28 Aug 1909, Arsene 2400 (BM, C, MICH, US), 25 July 1909, Arsène 2793 (US), 3 Oct 1909, Arsène 3078 (BM, GH, NY, US), 22 Aug 1909, Arsène 9894 (US). ESTADO DE MEXICO: 2 km al SE de Tepotzotlán, 8 Oct 1972, Rzedowski 29492 (CAS). DISTRITO FEDERAL: Valley of Mexico, 12 June 1896, Pringle 6314 (CAS, ENCB, M, MICH, MO, NY, UC, US); wet places near Mexico City, 24 July 1904, Pringle 13238 (C, CAS, F, GH, L, MICH, MO, US). HIDALGO: Molango District, Municipality Molango, Lake Atexca, 24 July 1947, Moore 3468 (GH, MICH, UC, US). VERACRUZ: Jicaltepec, Apr 1841, Liebmann 14451 (C); near Jalapa, 27 Apr 1899, Pringle 7814 (GH, US); Puente sobre el Río Jamapa, 15 km al SW of Huatusco, 11 Oct 1964, Rzedowski 19042 (ENCB).

GUATEMALA: ALTA VERAPAZ: near San Cristóbal, 9 Apr 1939, Standley 70988 (MICH); Cobán, June 1887, von Tuerckheim 1262 (GH, MICH, NY, US). BAJA VERAPAZ: about 4 mi S of Salamá, 10 July 1960, King 3262 (MICH, TEX, UC). JALAPA: between Jalapa and Montaña, 7 Dec 1939, Steyermark 32854 (F); Potrero Carrillo, at Hierba Buena, 14 mi NE of Jalapa, 11 Dec 1939, Steyermark 33007 (F).

EL SALVADOR: AHUACHAPAN: Lagunita las Ninjas, Apaneca, 28 Jan 1951, Fassett 28720 (F). CHALATENANGO: southeast-facing slope of Los Esesmiles, 1 Apr 1942, Tucker 1190 (F, GH, MICH, NY, UC, US).

HONDURAS: MORAZAN: along Choluteca River near Tegucigalpa, 8 Sep 1946, Molina $R$. 10508 (F, MO). OCOTEPEQUE: La Montañita, Cordillera Merendón, 31 Aug 1968, Molina R. 22581 (F), 22583 (F).

NICARAGUA: JINOTEGA: road to La Fundadora entering at km 142 from Managua, region of Santa María de Ostuma, 7 Dec 1958, Hawkes et al. 2205 (C, F).

COSTA RICA: CARTAGO: sedge marshes at Moravia de Chirripó, 8 Aug 1968, Davidse \& Pohl 1194 (F, MO). SAN JOSE: vicinity of Santa María de Dota, 14-26 Dec 1925, Standley 42448 (US); à la hacienda Belmira près Santa María, no date, Tonduz 11629 (US).

CUBA: CAMAGUEY: thickets not far from lagoon Macurijes Los Salacios, 7 Aug 1917, Bro. León \& Fr. Roca 7356 (NY).

HAITI: OUEST: Bayeux, at mouth of Rivière de Port Margot, north coast, between Cap Haitien and Le Borne, 19-24 June 1941, Bartlett 17461 (MICH, US); Plaine du Nord, Haïtien, Morne Rouge, 16 Dec 1924, Ekman H2914 (US); Mare Etablie, 2 mi W of Morne des Commissaires, 18 Sep 1955, Proctor 10877 (US).

JAMAICA: Troy, 16 Oct 1917, Harris 12580 (F, NY).
DOMINICAN REPUBLIC: DISTRITO NACIONAL: Santo Domingo, alto de Casabito, Bonao, 30 Mar 1974, Liogier 21303 (NY). LA VEGA: Orillas del Río Constanza, en los alrededores de Constanza, 27 Jan 1953, Jimenez 2556 (US). SAN JUAN: Piedra de Aguacate to Río de Oro, 9 Oct 1946, Howard \& Howard 9387 (BM, GH, MICH, NY, US).

PUERTO RICO: BAYAMON: Bayamón, Nov 1913, Hioram s.n. (NY, WTU).
SOUTH AMERICA: COLOMBIA: CUNDINAMARCA: Bogotá, 30 Apr 1944, Ewan 15585 (NO, UC).

VENEZUELA: LARA: Distrito Jiménez, entre la Encrucijada y el camino al Parque Nacional Yacambú de El Blanquito, SSE de Sanare, 7 Aug 1970, Steyermark et al. 103556 (NY).

BRAZIL: RIO DE JANEIRO: Rio de Janeiro, Oct 1831, Riedel 899 (BM, C). RIO GRANDE DO SUL: vicinity of São Leopoldo, Nov 1941, Leite 468 (NY); Municipio S. Leopoldo, Esteio, Nov 1931, Orth 678 (MO); Pôrto Alegre, Jan 1933, Orth 692 (MO). SANTA CATARINA: Rio Castelhanos, 9.1.62, Reitz \& Klein 11856 (UC).

PARAGUAY: MISIONES: Santiago, La Soledad, Isla Carpinche, 27 Dec 1965, Pedersen 7689 (C, L, NY).

ARGENTINA: CORRIENTES: Depto. General Paz, finca "El Rodeito," 2 Jan 1966, Krapovickas \& Cristóbal 11862 (UC); Depto. Mburucuyá, Estancia "Santa Teresa," 24 Nov 1951, Pedersen 1341 (C, GH, MO, NY); Depto. Empedrado, Estancia "La Yela," 25 Nov 1957, Pedersen 4669 (C, MO, NY, UC); Concepción, Fortín del Ibera, 18 Mar 1969, Pedersen 9067 (C, NY, UC). ENTRE RIOS: Concepción del Uruguay, no date, Lorentz 139 (B); Federación, Buena Esperanza, 21 Oct 1961, Pedersen 6234 (A, C, L); Depto. Uruguay, La Selmira, Isla Cupalén, 31 Mar 1967, Pedersen 8227 (C, L). FORMOSA: Depto. Formosa, 15 km E of Los Matacos, 11 Oct 1938, Eyerdam \& Beetle 22944 (UC); Depto. Pilcomayo, 15 Oct 1946, Morel 1443 (F). MISIONES: near Eldorado, 22 Jan 1975, Pedersen 10869 (C). SANTA FE: Depto. Garay, Helvecia, 20 Nov 1946, Huidobro 3235 (F).

Cyperus virens Michaux var. drummondii (Torrey \& Hooker) Kükenthal, Pflanzenreich IV. 20 (Heft 101): 181. 1936. Basionym: Cyperus drummondii Torrey \& Hooker, Ann. Lyceum Nat. Hist. New York 3: 437. 1836. Type: USA, Texas, Drummond 449 (K!, lectotype; B!, GH!, NY!, isolectotypes). Figure 15 (E-G).

Cyperus robustus Kunth, Enum. Pl. 2: 41. 1837. Type: Brasilia, Sello s.n. (B!, holotype).
Cyperus virens Michaux var. robustus (Kunth) Kukenthal, Pflanzenreich IV. 20 (Heft 101): 181. 1936.

Cyperus virens Michaux subsp. drummondii (Torrey \& Hooker) Koyama, Madroño 20: 254. 1970.

Plant usually 25-40 (-rarely to 90 ) cm tall; leaf sheath $2-10(-20) \mathrm{cm}$ long; leaf blade $3-5(-7) \mathrm{mm}$ wide at mid-length; involucral bracts up to $13(-22) \mathrm{cm}$ long, up to 7 mm wide; primary peduncles $2-5(-6)$, up to 2 cm long; secondary peduncles, when present, up to 1.3 cm long; primary heads with $60-70$ spikelets, the secondary ones with $7-16$ spikelets; bracteoles ca 2 mm long; spikelets $6-13 \mathrm{~mm}$ long, $1.5-2.2$ $(-2.5) \mathrm{mm}$ wide, with $20-40$ scales; rachilla with transverse scale scars $0.5-0.6 \mathrm{~mm}$ apart on each side; scale angles $45^{\circ}$; scales 1.3-1.6 ( -1.8 ) mm long, $1-1.2 \mathrm{~mm}$ wide, or $0.5-0.6 \mathrm{~mm}$ wide in lateral view, the proximal abaxial groove between the two keels 0.8 mm long; medial part of scale stramineous and sometimes tinged green, occasionally glaucous; sides of scale light brown to golden brown or reddish brown, basally attached to the rachilla for 0.4 mm ; stamens one or two, $1.5-1.9 \mathrm{~mm}$ long, the filaments $1.2-1.6 \mathrm{~mm}$ long, the anthers ca 0.6 mm long; style ca 0.6 mm long, the stigmatic branches ca 0.4 mm long; achene filling seven-eighths or more of the scale, radially or bilaterally symmetric or asymmetric, reddish brown, brown, or blackish, broadly to narrowly trigonous, obtusely angled, two and one-half to four times longer than wide, $1.1-1.3 \mathrm{~mm}$ long (total length), the body $1-1.2 \mathrm{~mm}$ long; achenial surfaces usually equal in width, $0.3-0.5 \mathrm{~mm}$ wide, sometimes one of the abaxial surfaces 0.1 mm wider than the other two sides, or the adaxial surface wider than the abaxial ones, ovate, the adaxial surface planar, the abaxial surfaces planar or concave on the lower one-half and slightly convex on the upper one-half.

Distribution. Known in North America only from Texas and Louisiana, Nicaragua, and Jamaica, and in South America from the Galapagos Islands, Surinam, and Brazil. In swamps, fern-sedge meadows, open pine woodlands, or Miconia forests, from sea level to 700 meters in elevation (Fig. 17).

Discussion. The scales of variety drummondii are similar to those of variety minarum in that they are apically rounded and often reddish brown on the sides, but differ primarily in size, being smaller than those of any of the other varieties of $C$. virens. The dimensions of the achenes are intermediate between those for variety virens and variety minarum.

The distribution of variety drummondii in three widely separated areas is difficult to explain. At the present time, extinction of intermediate populations appears the most feasible explanation for its disjunctive pattern.

## Representative specimens:

UNITED STATES OF AMERICA: LOUISIANA: PLAQUEMINES PARISH: Pointe à la Hache, Abbeville, 28 May 1884, Langlois $855 c$ (DS, NY).

TEXAS: HARRIS CO: Houston, 1872, Hall s.n. (F). ORANGE CO: $61 / 2 \mathrm{mi} \mathrm{W}$ of Orange, 16 Nov 1945, Cory 50890 (LL).

NICARAGUA: ZELAYA: between Siuna and Limbaikan, 17 Mar 1971, Svenson 4986 (F). JAMAICA: Cockpit Country, 13-18 Sep 1906, Britton 460 (NY).
SOUTH AMERICA: SURINAM: NICKERIE: Sipaliwini savanna area on Brazilian frontier, in Maurisie swamp veg., 3-9-1968, Oldenburger et al. ON51 (NY).

ECUADOR: GALAPAGOS ISLANDS: CHATHAM ISLAND (I. San Cristóbal): Wrick Bay, 23 Feb 1906, Stewart 1075 (BISH, MO, NY). INDEFATIGABLE ISLAND (I. Santa Cruz): upper
end of Miconia Forest, 31 Jan 1964, Fournier 119 (NY); mountain above Fortuna, 21 May 1959, Harling 5093 (NY); W of Cerro Copa, 6 Feb 1964, Wiggins 18571 (DS), 18572 (DS); along trail to Mt. Crocker, 6 Feb 1964, Wiggins 18588 (DS); S slope of Mt. Crocker, 18 Feb 1967, Wiggins \& Porter 680 (CAS, NY).

BRAZIL: BAHIA: Santo Amaro, Rincão dos Mellos, Nov 1922, Jurgens 24 (B). MINAS GERAIS: Itatiaya, 1200 m , Dec 1892, Kuntze s.n. (NY); RORAIMA: Rio Branco, Serra do Banco, Oct 1909, Ule 8060 (L). SAO PAULO: Rio Tietê, 26 Feb 1905, Usteri 9371 (NY).


Figure 17. Distribution of Cyperus virens var. drummondii, C. virens var. minarum, and $C$. virens var. montanus.

Cyperus virens Michaux var. minarum (Böckeler) Denton, comb. nov. Basionym: Cyperus minarum Böckeler, Beitr. Cyper. 2: 5. 1890. Type: Brasil, Minas Gerais, 1845, Widgren s.n. (C!, isotype; holotype?, not located at B). Figure 15 (H-K).

Cyperus consanguineus Kunth var. minarum (Böckeler) Kukenthal, Pflanzenreich IV. 20 (Heft 101): 172. 1936.

Plant usually $20-120 \mathrm{~cm}$ tall; leaf sheath $4-15(-21) \mathrm{cm}$ long; leaf blade $6-8 \mathrm{~mm}$ wide at mid-length; involucral bracts up to 31 cm long, up to 5 mm wide; primary peduncles $7-10$, up to 7 cm long; secondary peduncles absent or $1-7$, up to 2 cm long; primary heads with $10-20$ spikelets, the secondary ones with $10-14(-20)$ spikelets; bracteoles $2-2.5 \mathrm{~mm}$ long; spikelets $5-6.5 \mathrm{~mm}$ long, $2.2-2.5 \mathrm{~mm}$ wide, with $14-18$ scales; rachilla with transverse scale scars 0.7 mm apart; scale angles ca $45^{\circ}$; scales $1.5-1.8(-2) \mathrm{mm}$ long, $1-1.2 \mathrm{~mm}$ wide, or $0.5-0.8 \mathrm{~mm}$ wide in lateral view, the proximal abaxial groove between the two keels $0.6-0.8 \mathrm{~mm}$ long; medial part of scale stramineous or reddish brown; sides of scale reddish brown, or stramineous streaked with red glands, or stramineous, basally attached to the rachilla for 0.3 mm ; stamens one or two, $2-2.5 \mathrm{~mm}$ long, the filaments $1-1.5 \mathrm{~mm}$ long, the anthers $1-1.3 \mathrm{~mm}$ long; style 1 mm long, the stigmatic branches ca 0.8 mm long; achene filling two-thirds or more of the scale, radially or bilaterally symmetric or sometimes asymmetric, light brown to brown, broadly trigonous, obtusely angled, two to two and one-half times longer than wide, ca 1.2 mm long (total length), the body ca 1.1 mm long; achenial surfaces equal or unequal in width, $0.5-0.6 \mathrm{~mm}$ wide, occasionally one of the abaxial surfaces $0.1-0.2 \mathrm{~mm}$ narrower than the other two sides, elliptic, the adaxial surface planar or concave, the abaxial surfaces concave or concave on the lower one-half and convex on the upper one-half.

Distribution. Known from the Dominican Republic, from Chiapas, Mexico, from Guatemala, Honduras, Nicaragua, Costa Rica, and from Minas Gerais, Brazil. Found in montane cloud forests, virgin rainforests on limestone mountains, on heavily forested slopes with Abies guatemalensis, Podocarpus and Quercus or with Quercus and Magnolia or with Quercus and Drimys, cornfields, or in woods on serpentine soils, at elevations from 430 to 3030 meters (Fig. 17).

Discussion. The habit of variety minarum is nearly as large as that of variety virens, but the plants of variety minarum have shorter primary peduncles, fewer scales per spikelets, and broader achenes (two times longer than wide) with larger stipitate bases. The scales are typically rounded distally, rather than distinctly keeled. Young scales tend to be paler and more glaucous than older ones.

Achenes formed in the inflorescences are often abortive, but some normal ones are found. In a specimen from Honduras (Molina R. 14019), the compound inflorescence bears normal (fertile) spikelets as well as leafy vegetative shoots.

Representative specimens:
MEXICO: MICHOACAN: vicinity of Morelia, 15 Oct 1909, Arsène 3118 (MO, US). ESTADO DE MEXICO: "flora del Valle de Mexico," 1875, Schaffner 3 (NY). CHIAPAS: N edge of San Cristóbal de las Casas, 3 Aug 1964, Breedlove 6782 (F, NY); Mpio. Tenejapa, along road to San Cristóbal las Casas above Tenejapa Center, 12 July 1965, Breedlove 10867 (ENCB, F, MICH, NY); Mpio. Amatenango del Valle, 27 July 1966, Breedlove 14678 (DUKE, ENCB, NY); on boundary between Zinacantán and Chamula along the road to Zinacantán Center, 20 Jan 1965, Breedlove \& Raven 8139 (ENCB, LL, MO); San Cristóbal de las Casas, 12 Apr 1966, Laughlin 648 (ENCB, NY); Mpio. Tenejapa in Paraje Balum K'anal, 13 Apr 1966, Ton 850 (ENCB, LL, NY); Mpio. Tenejapa, at the Paraje Matsab, 12 May 1966, Ton 936 (ENCB, LL, MICH, MO, NY), 28 Sep 1966, Ton 1265 (DUKE, ENCB, LL, MICH, NY), 28 Sep 1966, Ton 1295 (DUKE, NY); in the colonia of 'Ach'lum, Mpio. of Tenejapa, 15 May 1967, Ton 2379 (ENCB, MO).

GUATEMALA: ALTA VERAPAZ: near San Cristóbal, 9 Apr 1939, Standley 70988 (F, MICH). HUEHUETENANGO: about Laguna de Ocubilá, east of Huehuetenango, 7 Jan 1941, Standley 82675 (F), 82716 (F). JALAPA: between Miramundo and summit of Montaña

Miramundo, between Jalapa and Mataquescuintla, 6 mi S of Miramundo, 5 Dec 1939, Steyermark 32661 (F). SANTA ROSA: dried bed of Laguna de Escondita de Tecuamburro, 20 mi S of Barberena, 21 Feb 1951, Fassett 28912 (F).

EL SALVADOR: CHALATENANGO: southeast-facing slope of Los Esesmiles, 1 Apr 1942, Tucker 1190 (LL).

HONDURAS: INTIBUCA: 9 kms al E de La Esperanza, 23 May 1964, Molina \& Molina 14019 (BM, F). MORAZAN: matorrales cenagosos en faldas de Montaña Uyuca, 19 July 1963, Molina R. 12791 (F, NY); Piedra Herrada, lower slopes of Cerro de Uyuca, 7 Aug 1947, Standley 11925 (F); Las Flores, slopes of Cerro de Uyuca, 25 July 1949, Standley 21681 (F); western slopes of Cerro de Uyuca, along trail from Las Flores toward Talumbla, 17 Aug 1949, Standley 22741 (F).

NICARAGUA: MATAGALPA: Cordillera Central de Nicaragua, Finca Sta. María de Ostuma, 18 Jan 1965, Williams et al. 28002 (F).

COSTA RICA: SAN JOSE: Laguna de la Chanta, 18 Dec 1925, Standley 42229 (F); Santa Maria de Dota, Dec 1925, Standley 42448 (F); Santa María, 27 May 1928, Stork 2419 (MICH).

DOMINICAN REPUBLIC: INDEPENDENCIA?: limestone mountains of the Sierra de Neiba, along the Haitian border, vicinity line between provinces of San Rafael \& Independencia, 4 Aug 1967, Gastony et al. 521 (GH, NY, US).

SOUTH AMERICA: URUGUAY: RIO NEGRO: Cerro Largo, Palleros, Dec 1937, Gallinal et al. B2372 (NY).

ARGENTINA: PROVINCIA NOT KNOWN: Depto. Tapenaga, Loc. Enrique Urien, Campo Bonazzola, Nov 1940, Rodrigo 2503 (NY).

Cyperus virens Michaux var. montanus (Böckeler) Denton, comb. nov. Basionym: Cyperus montanus Böckeler, Beitr. Cyper. 2: 4. 1890. Type: Argentina, Picada a’ San Pedra, Cordillera de Misiones, 29 Oct 1886, Niederlein 2116 (B!, holotype). Figure 18.

Cyperus uleanus Böckeler, Beitr. Cyper. 2: 5. 1890. Type: Brasil, in gräben am Kleinen Fluss bei Itajahy, Ule 556 (B!, holotype).

Plant up to 75 cm tall; leaf sheath up to 28 cm long; leaf blade $4-10 \mathrm{~mm}$ wide at mid-length; involucral bracts up to 35 cm long, up to 12 mm wide; primary peduncles $7-15$, up to 12 cm long; secondary peduncles up to 3 cm long; tertiary peduncles, when present, up to 1 cm long; primary heads with $25-60$ spikelets, the secondary ones with $10-50$ spikelets, the tertiary ones with $10-15$ spikelets; bracteoles $2-5 \mathrm{~mm}$ long; spikelets $7-10 \mathrm{~mm}$ long, $3-3.6 \mathrm{~mm}$ wide, with $14-26$ scales; rachilla with transverse scale scars 0.6 mm apart on each side; scale angles $45^{\circ}\left(-60^{\circ}\right)$; scales $1.5-1.9(-2) \mathrm{mm}$ long, $1.1-1.3 \mathrm{~mm}$ wide, or $0.4-0.5(-0.6) \mathrm{mm}$ wide in lateral view, the proximal abaxial groove between the two keels $0.5-0.8 \mathrm{~mm}$ long; medial part of scale light green or golden brown with a greenish tinge; sides of scale golden brown, basally attached to the rachilla for $0.2-0.3 \mathrm{~mm}$; stamen solitary, $2-2.3 \mathrm{~mm}$ long, the filament ca 1.5 mm long, the anther 0.8 mm long; style 1 mm long, the stigmatic branches ca 0.5 mm long; achene filling one-half to two-thirds of the scale, radially symmetric, brown to brownish black, broadly trigonous, acutely angled, two to two and one-half times longer than wide, $1.1-1.2 \mathrm{~mm}$ long (total length), the body $0.8-1 \mathrm{~mm}$ long, the stipitate base sometimes slightly enlarged below the constriction; achenial surfaces equal in width, $0.4-0.5 \mathrm{~mm}$ wide, obovate or occasionally elliptic or ovate, slightly concave.

Distribution. Variety montanus occurs in the southern part of South America, from southern Brazil west to Uruguay, Argentina, and Chile. In wet places along roadsides, streams, or rivers, or around lakes, at elevations from 700 to 950 meters (Fig. 17).

Discussion. Features of the achene easily distinguish variety montanus from related taxa. The achenes are broadly trigonous, occupy less than two-thirds of the scales, and have thickened stipes. Vegetatively, variety montanus is similar to variety virens, but differs by its achenes and by a diffuse compound inflorescence created by primary, secondary, and tertiary peduncles. (The compound inflorescences of all other


Figure 18. A-E. Cyperus virens var. montanus (based on specimen from Berlin Herbarium, no. 83, no collector specified, from "Herbar Rudolf Gross"); A, habit, $\times \frac{112}{2}$; B, primary peduncle and part of compound inflorescence, $\times 1 / 2$; C, spikelet, $\times 5$; D, scale, $\times 15$; E, achene, $\times 15$.
varieties of $C$. virens lack tertiary peduncles.) The most geographically restricted variety of $C$. virens, variety montanus is also the least variable morphologically.

Representative specimens:
SOUTH AMERICA: BRAZIL: PARANA: Pinhaes, Piraquara, 1 Mar 1970, Hatschbach 23956 (C). RIO GRANDE DO SUL: Pôrto Alegre, 2 Nov 1957, Camargo 2445 (B). SANTA CATARINA: Santa Cecilia, 1 Feb 1962, Reitz \& Klein 11360 (UC); Morro Pinheiro Sêco, Lajes, 17 Dec 1962, Reitz \& Klein 14058 (L); Mun. Papanduva, bog north of Papanduva on the Estrada de Rodagem Federal, 7 Dec 1956, Smith \& Klein 8412 (L); bei Blumenau, Oct 1888, Ule 962 (B). SAO PAULO: Butantan, 10 Jan 1921, Gehrt 5406 (GH), Hoehne 5406 (B).

URUGUAY: CANELONES: Bañados de Canelones, no date, Caldevilla s.n. (MICH). SAN JOSE: Barra Sta. Lucía, 11 Mar 1931, Osten 22189 (GH), 16 Jan 1932, Osten 22432 (F).

ARGENTINA: MISIONES: Campinas de Americo, 15 Dec 1886, Niederlein 2060 (B); Cordillera de Misiones, Picada à San Pedro, 29 Oct 1886, Niederlein 2116 (B).

CHILE: NUBLE: Chillán, 2 Jan 1904, Elliot 336 (BM).

## EXCLUDED OR EXTRALIMITAL NAMES

1. Cyperus acutangulus Böckeler, Linnaea 35: 551. 1868. Type: Chile, no locality specified in description, Chamisso s.n.; not found. This name may refer to $C$. virens var. montanus but positive determination cannot be made from the description. Kükenthal (1936) recognized the name as C. virens var. acutangulus (Böckeler) Kükenthal.
2. Cyperus altsonii Kükenthal, Kew Bull. 1932: 322. 1932. Type: British Guiana, Altson 492 (NY!, isotype). The spikelets and scales of the type collection are larger than those of the Luzulae group, and the scales have many nerves rather than just three.
3. Cyperus bakeri C. B. Clarke, J. Linn. Soc., Bot. 20: 290. 1883. Type: Mauritius, Gardner s.n.; not found. The description indicates C. ochraceus, but positive identification could not be made.
4. Cyperus buchananii Kirk, Trans. \& Proc. New Zealand Inst. 10: App. 41. 1878. Type: not located. Kükenthal (1936) synonymized this name with C. eragrostis Lamarck.
5. Cyperus celluloso-reticulatus Böckeler, Allg. Bot. Z. Syst. 1: 202. 1895. Type: Brazil, in Sümpfen bei Tabarão, Prov. Santa Catarina, Feb 1889, Ule 1332 (B!, holotype). This species differs from those of the Luzulae group in that the scales are uniformly thin, lacking a thickened middle portion, and the achenes are lenticular and yellow instead of trigonous and brown or black.
6. Cyperus columbiensis Palla, Oesterr. Bot. Z. 68: 389. 1908. Type: Colombia, San Cristóbal bei Bogotá, July 1905, Apollinaire s.n. (L!, presumably an isotype). The scales of the spikelets of the type collection are somewhat spiral, not two-ranked as in the Luzulae group, and they disarticulate with a small segment of the rachilla, a feature not found in the Luzulae group.
7. Cyperus compressus Jacquin, Hort. Bot. Vindob. 3: 10. 1776. Type: not found. The description suggests $C$. surinamensis Rottb $\phi 11$, especially the collections of C. surinamensis made in Jamaica and Puerto Rico.
8. Cyperus declinatus Moench, Meth. 317. 1794. Type: not found or mentioned in description. Kükenthal (1936) synonymized this name with C. eragrostis Lamarck, but the description alone does not allow positive identification.
9. Cyperus globuliferus Link, Jahrb. Gewächsk. 1 (Heft 3): 89. 1820. Type: Not found. The description suggests C. luzulae (Linnaeus) Retzius.
10. Cyperus hieronymi Böckeler, Beitr. Cyper. 1: 7. 1888. Type: Argentina, Prov. Salta, Lorentz \& Hieronymus s.n. (B!, holotype). The scales are mostly
five-nerved and are uniformly thin; they are not bicarinate basally as in the Luzulae group. There are three stamens, not the one or two characteristic of the Luzulae group.
11. Cyperus incomtus Kunth, Enum. Pl. 2: 39. 1837. Type: Brazil, Kunth s.n. (photograph at GH! of holotype located at B). The plants appear most similar to those of taxa currently included in section Glutinosi as defined by Kükenthal (1936); the scales have many nerves and the rachillas are winged.
12. Cyperus incomtus Kunth var. miguelii Kükenthal, Pflanzenreich IV. 20. (Heft 101): 183. 1936. Type: Bolivia, Bang 2087 (GH!, MICH!, isotypes). This varietal name is correctly associated with C. incomtus Kunth.
13. Cyperus ochrocephalus Steudel, Flora 25: 601. 1842. Type: Juan Fernandez Islands, Bertero 1450 ; not found. The description suggests C. eragrostis Lamarck.
14. Cyperus pauloensis Palla, Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. 39: 175. 1908. Type: not found.
15. Cyperus prionotropis Steudel, Flora 25: 601. 1842. Type: Chile, in sabulosis secus torrentes Taguabagua, Bertero 314; not found. The description indicates $C$. eragrostis Lamarck.
16. Cyperus reflexus Vahl var. genuina forma evoluta Osten, Anales Mus. Nac. Montevideo, II. 3: 136. 1931. Type: Uruguay; not found. The description of this form suggests C. rufescens (a synonym of C. reflexus var. reflexus), but positive identification could not be made.
17. Cyperus reflexus Vahl var. genuina forma evoluta Osten subforma flaccida Osten, Anales Mus. Nac. Montevideo, II. 3: 136. 1931. Type: Uruguay, Cerro Largo: not found. The description fits C. reflexus, but it does not distinguish between the two varieties recognized in this study.
18. Cyperus reflexus Vahl var. genuina forma evoluta Osten subforma glaucovirens Osten, Anales Mus. Nac. Montevideo, II. 3: 137. 1931. Uruguay, Depto. de San José, entre Sta. Lucía y Libertad, 28 Feb 1918, Osten s.n.; not found. The description fits $C$. reflexus, but it does not distinguish between the two varieties recognized in this study.
19. Cyperus scaberrimus Böckeler, Beitr. Cyper. 2: 3. 1890. Type: Brazil, am bache bei Itajahy, Dec 1885, Ule 558 (B!, holotype). This species does not belong in the Luzulae group because the scales are seven-nerved and glandular adaxially, lack a proximal abaxial groove, and do not readily disarticulate from the rachilla. Kükenthal (1936) treated the name as C. virens var. scaberrimus (Böckeler) Kükenthal.
20. Cyperus vegetus Willdenow var. obtusangulus O. Kuntze, Rev. Gen. 3, pt. 2: 334. 1898. Type: not found. The description suggests C. eragrostis Lamarck.
21. Cyperus venturii Kükenthal, Pflanzenreich IV. 20 (Heft 101): 182. 1936. Type: Argentina, Prov. Tucumán, Barranca Colorada, 15 Feb 1926, Venturi 4096 (UC!, isotype): The type collection does not belong with the Luzulae group, but is closely allied to section Glutinosi as defined by Kükenthal (1936); the scales are many-nerved and the rachillas winged.
22. Cyperus virens Michaux var. glauco-pallidus Böckeler, Linnaea 35: 554. 1868. Type: Brazil, no locality specified, Sello s.n. (B!, holotype). This species may be of hybrid origin, as suggested by morphological studies, with the putative parents $C$. virens and $C$. xanthostachys. The type specimen does not belong to the Luzulae group because the scales are five-nerved with the margins straight and somewhat erose (similar to C. xanthostachys). As in C. virens, the stems are triquetrous, and the foliage leaves and involucral bracts are nodulose with transverse septa. With an inflorescence that is mostly immature, the reproductive parts are not readily evident and the gynoecia that are visible are aborted.
23. Cyperus xanthostachys Steudel, Flora 35: 600. 1842. Type: not found. If properly interpreted from the description, the plants that belong to this species differ
from those of the Luzulae group in that there are two to three stamens per flower with the filaments one to two times longer than the subtending scale, and the scales appear spirally arranged instead of distichous.

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# INDEX TO NAMES USED IN THE LUZULAE GROUP OF CYPERUS ( $C=$ Cyperus; $S=$ Scirpus) 

C. acuminatus Torrey \& Hooker
C. acuminatus Torrey \& Hooker var. cyrtolepis (Torrey \& Hooker) Kukenthal = C. acuminatus Torrey \& Hooker
C. arenicola Steudel = C. pseudovegetus Steudel var. pseudovegetus
C. baazas Steudel = C. reflexus var. reflexus
C. baenitzii Böckeler $=C$. virens Michaux var. virens
C. bangianus Gandoger $=$ C. luzulae $($ Linnaeus $)$ Retzius
C. bipontini Böckeler $=$ C. surinamensis Rottb $\phi 11$
C. calcaratus Nees ex S. Watson \& Coulter = C. pseudovegetus Steudel var. pseudovegetus
C. chamissoi Schrader ex Nees $=$ C. intricatus Schrader ex Roemer
C. ciliolatus Böckeler $=$ C. intricatus Schrader ex Roemer
C. conoideus L. C. Richard = C. luzulae (Linnaeus) Retzius
C. consanguineus Kunth $=$ C intricatus Schrader ex Roemer
C. consanguineus Kunth var. chamissoi (Schrader ex Nees) Kukenthal = C. intricatus Schrader ex Roemer
C. consanguineus Kunth var. minarum (Böckeler) Kukenthal $=C$. virens var. minarum (Böckeler) Denton
C. consanguineus Kunth var. varius (Böckeler) Kukenthal $=C$. intricatus Schrader ex Roemer
C. cyrtolepis Torrey \& Hooker $=$ C. acuminatus Torrey \& Hooker
C. cyrtolepis Torrey \& Hooker var. arenicola (Steudel) Böckeler = C. pseudovegetus Steudel var. pseudovegetus
C. cyrtolepis Torrey \& Hooker var. denticarinatus (Britton) Britton = C. acuminatus Torrey \& Hooker
C. denticulatus Schrader ex Roemer \& Schultes = C. surinamensis Rottb $\phi$ ll
C. distinctus Steudel
C. drummondii Torrey \& Hooker $=$ C. virens Michaux var. drummondii (Torrey \& Hooker) Kukenthal
C. entrerianus Böckeler $=C$. luzulae (Linnaeus) Retzius
C. entrerianus Böckeler var parvicapitatulatus Kukenthal $=C$. luzulae (Linnaeus) Retzius
C. eragrostis Lamarck
C. eragrostis Lamarck forma latifrons Kukenthal =C. eragrostis Lamarck
C. eragrostis Lamarck forma tener Kukenthal $=$ C. eragrostis Lamarck
C. eragrostis var. compactus $($ Desvaux) Kükenthal $=$ C. eragrostis Lamarck
C. formosus Vahl = C. virens Michaux var. virens
C. fraternus Kunth $=$ C. reflexus Vahl var. fraternus (Kunth) Kuntze
C. guatemalensis Gandoger $=C$. luzulae (Linnaeus) Retzius
C. haemostachys Steudel = C. reflexus Vahl var. reflexus
C. intricatus Schrader ex Roemer
C. longicaulis Böckeler $=$ C. intricatus Schrader ex Roemer
C. luzulae (Linnaeus) Retzius
C. luzulae (Linnaeus) Retzius forma pallidiflorens Kukenthal = C. luzulae (Linnaeus) Retzius
C. luzulae (Linnaeus) Retzius var. entrerianus (Böckeler) M. Barros = C. luzulae (Linnaeus) Retzius
C. luzulae (Linnaeus) Retzius var. minor Böckeler = C. luzulae (Linnaeus) Retzius
C. luzulae (Linnaeus) Retzius var. tucumanensis (Böckeler) C. B. Clarke = C. luzulae (Linnaeus) Retzius
C. luzulae (Linnaeus) Retzius var. umbellulatus Britton $=$ C. pseudovegetus Steudel var. pseudovegetus
C. minarum Böckeler $=C$. virens Michaux var. minarum $($ Böckeler $)$ Denton
C. monandrus Roth $=$ C. eragrostis Lamarck
C. montanus Böckeler $=$ C. virens Michaux var. montanus (Böckeler) Denton
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C. ochraceus Vahl var. excelsior Kukenthal = C. ochraceus Vahl
C. ochraceus Vahl var. minor Kukenthal = C. ochraceus Vahl
C. pseudosurinamensis Böckeler = C. luzulae (Linnaeus) Retzius
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C. pseudovegetus Steudel var. megalanthus Kükenthal
C. pseudovegetus Steudel var. pseudovegetus
C. reflexus Vahl var. fraternus (Kunth) Kuntze
C. reflexus Vahl var. intricatus (Schrader ex Roemer) Kükenthal = C. intricatus Schrader ex Roemer
C. reflexus Vahl var. macrostachys Böckeler $=$ C. reflexus Vahl var. reflexus
C. reflexus Vahl var. reflexus
C. robustus Kunth $=C$. virens Michaux var. drummondii (Torrey \& Hooker) Kukenthal
C. rufescens Torrey \& Hooker $=$ C. reflexus Vahl var. reflexus
C. rufescens Torrey \& Hooker var. denticarinatus Britton = C. acuminatus Torrey \& Hooker
C. schenkianus Böckeler $=$ C. intricatus Schrader ex Roemer
C. sellowii Link $=$ C. reflexus Vahl var. reflexus
C. serrulatus S . Watson $=$ C. eragrostis Lamarck
C. sphaerostachys Link $=$ C. luzulae (Linnaeus) Retzius
C. subenervius Steudel = C. surinamensis Rottb $\phi 11$
C. surinamensis Rottb $\phi 11$
C. surinamensis Rottb $\phi 11$ var. formosus (Vah1) Kukenthal = C. virens Michaux var. virens
C. surinamensis Rottb $\phi 11$ var. lutescens $\mathrm{Böckeler}=$ C. surinamensis Rottb $\phi 11$
C. surinamensis Rottb $\phi 1$ var. strictus Kukenthal = C. reflexus Vahl var. fraternus (Kunth) Kuntze
C. surinamensis Rottb $\phi 1$ var. viridis B öckeler $=$ C. surinamensis Rottb $\phi 1$
C. trinitatis Steudel $=$ C. luzulae (Linnaeus) Retzius
C. tucumanensis Böckeler = C. luzulae (Linnaeus) Retzius
C. uleanus Böckeler $=C$. virens Michaux var. montanus (Böckeler) Denton
C. usteri Palla $=$ C. intricatus Schrader ex Roemer
C. varius Böckeler $=$ C. intricatus Schrader ex Nees
C. vegetus Willdenow $=$ C. eragrostis Lamarck
C. vegetus Willdenow var. compactus Desvaux = C. eragrostis Lamarck
C. vegetus Willdenow var. triangularis Böckeler = C. eragrostis Lamarck
C. vegetus Willdenow var. trigonus Kuntze $=$ C. eragrostis Lamarck
C. virens Michaux subsp. drummondii (Torrey \& Hooker) Kükenthal = C. virens Michaux var. drummondii (Torrey \& Hooker) Kukenthal
C. virens Michaux var. arenicola (Steudel) Shinners = C. pseudovegetus Steudel var. pseudovegetus
C. virens Michaux var. brittonii C. B. Clarke = C. distinctus Steudel
C. virens Michaux var. drummondii (Torrey \& Hooker) Kukenthal
C. virens Michaux var. minarum (Böckeler) Denton
C. virens Michaux var. montanus (Böckeler) Denton
C. virens Michaux var. robustus (Kunth) Kukenthal = C. virens Michaux var. drummondii (Torrey \& Hooker) Kukenthal
C. virens Michaux var. virens
C. virens Michaux var. widgrenii (Böckeler) C. B. Clarke ex M. Barros = C. intricatus Schrader ex Roemer
C. widgrenii Böckeler $=C$. intricatus Schrader ex Nees
S. luzulae Linnaeus = C. luzulae (Linnaeus) Retzius


[^0]:    1. Achenes with conspicuous white to light brown spongy and torulosic bases ca 0.2 mm long and as wide as the rest of the achenes; stems glabrous; North America. C. distinctus.
    2. Achenes with or without prominent stipitate bases, lacking enlarged spongy tissues at the bases; stems glabrous to scabrous; North and South America.
    3. Stems scabrous to scabrellate at least below the involucral bracts, either generally over the surface or just on the angles.
